CALTRANS BMP RETROFIT PILOT PROGRAM
DISTRICT 7, LOS ANGELES

CTSW-RT-02-037

FOURTH YEAR 2001/02 REPORT

CONTINUOUS DEFLECTIVE SEPARATION UNITS

OPERATIONS, MAINTENANCE & MONITORING

SEPTEMBER 2002

Prepared for:
CALIFORNIA DEPARTMENT OF TRANSPORTATION
1120 N STREET
SACRAMENTO, CA 95826

CALTRANS BMP RETROFIT PILOT PROGRAM

DISTRICT 7, LOS ANGELES

CTSW-RT-02-037

FOURTH YEAR 2001/02 REPORT

CONTINUOUS DEFLECTIVE SEPARATION UNITS OPERATIONS, MAINTENANCE & MONITORING

Prepared for:

State of California

Department of Transportation

SEPTEMBER 2002

CALTRANS
BMP RETROFIT PILOT PROGRAM

DISTRICT 7, LOS ANGELES

FOURTH YEAR 2001/02 REPORT

CONTINUOUS DEFLECTIVE SEPARATION UNITS

OPERATIONS, MAINTENANCE & MONITORING

SEPTEMBER 2002

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURES

TABLE OF CONTENTS (Continued)

FIGURES (Continued)

TABLE OF CONTENTS (Continued)

TABLES

TABLE OF CONTENTS (Continued)

APPENDIX

1.0 STORMWATER DATA

This report summarizes the results of the monitoring, operation, and maintenance program for the Continuous Deflective Separation units (CDS™) from June 2001 through May 2002. The Orcas Avenue and Filmore Street CDS™ units are a Best Management Practice (BMP) device under evaluation in the Caltrans District 7 "BMP Retrofit Pilot Program." Refer to Figure 1-1 for locations of the CDS™ units.

1.1 Objective

The primary objectives of the BMP Retrofit Pilot Program for the CDS™ units are to evaluate the performance of the CDS™ units and the level of effort required to operate and maintain the units. The water quality monitoring study is designed to estimate the CDS™ units' ability to remove pollutants from stormwater runoff and to understand the level of effort required to operate and maintain the units at their optimal effectiveness.

Monitoring data contained in this report for the CDS™ units was collected from October 2001 through April 2002 (the 2001/02 wet season) and is used to evaluate the CDS™ units' performance. Operations and maintenance data collected from June 2001 through May 2002 is also contained in this report.

Data collected includes the following:

- Rainfall data from storm events during the 2001/02 wet season.
- Water quality of runoff flowing into and discharging from the CDS™ units.
- Flow quantities discharging from the CDS™ units.
- Empirical observations of water quality, rainfall, and antecedent conditions related to the CDS™ units.
- Documentation of inspection and maintenance activities performed at the CDS™ units.

In addition to the above data, this report contains characterization results of the following:

- Sump water from the Orcas Avenue CDS™ Unit and Filmore Street CDS™ Units.
- Gross pollutants captured and bypassed by the Orcas Avenue and Filmore Street CDS™ Units.
- Characterizations of the gross pollutants and litter collected from the Orcas Avenue and Filmore Street CDS™ Units.
- Water Quality Pollutant Removal Efficiencies for the Orcas Avenue and Filmore Street CDS™ Units for the 2001/02 data as well as 2-year (2000/02) data.

1.2 Hydrology

The following sections describe the site-specific hydrologic conditions observed during the 2001/02 wet season.

1.2.1 Precipitation During Wet Season

Over the entire Los Angeles Basin, excluding mountain locations, the average annual precipitation ranges from less than 304.8 mm (12 in) on the immediate coast to more than 508 mm (20 in) in the foothills. On average, 92% of the seasonal precipitation falls between November 1st and April 30th. This percentage is roughly the same for all stations regardless of the elevation or the distance from the ocean (National Weather Service, *The Climate of Los Angeles California*).

Between July 1, 2001 and April 30, 2002, Southern California was drier than normal. During this time, approximately 110.74 mm (4.36 in) of precipitation fell on the downtown Los Angeles area. This precipitation represents only 30% of the normal average rainfall for downtown Los Angeles 375.16 mm, (14.77 in). Data collected for the downtown Los Angeles area since 1877 indicates that the 2001/02 wet season was the driest year (to date) on record. Prior to this, 1960/61 was the driest year with 123.19 mm (4.85 in) of precipitation. (National Weather Service, *Public Information Statement for Los Angeles/Oxnard, May 1, 2002*)

1.2.2 Precipitation During Monitored Events

Precipitation for each storm event sampled during the wet season was characterized by the total event rainfall, duration of rainfall, maximum intensity, cumulative precipitation for the season, days since last rainfall (antecedent dry days), and the magnitude of the event immediately preceding the monitored storm event (antecedent event rain). The antecedent event rain must meet the Caltrans criteria for a precipitation event. A Caltrans precipitation event is defined as the following:

> "For the purposes of these protocols, a precipitation event shall begin with six consecutive hours during which a sum total of at least 2.54 mm (0.10 inches) of rain falls, and end with six consecutive hours in each of which no rainfall greater than 0.254mm (0.01 inches) of rain is recorded. The precipitation event so identified shall be truncated so that it both begins and ends in hours with rainfall equal to or greater than 0.254 mm (0.01 inches)." *(Caltrans: 2001-2002 Water Quality Data-Reporting Protocols, CTSW-RT-01-057)*

- Figure 1-2 illustrates the daily precipitation totals for the 2001/2002 wet season for the Orcas Avenue CDS™ unit.

- Figure 1-3 illustrates the daily precipitation totals for the 2001/2002 wet season for the Filmore Street CDS™ unit.

- Table 1-a summarizes the precipitation characteristics of each sampled storm event at the CDS™ units. The table includes the start and end dates and times of the rainfall, duration of rainfall, total rainfall, maximum rainfall intensity, antecedent dry days, antecedent event rain, and the seasonal cumulative precipitation prior to the storm event.

- Figures 1-4 through 1-10 illustrate the event rainfall, duration of rainfall, and the maximum rainfall intensity for the sampled storm events at the Orcas Avenue CDS™ unit.

- Figures 1-11 through 1-20 illustrate the event rainfall, duration of rainfall, and the maximum rainfall intensity for the sampled storm events at the Filmore Street CDS™ unit.

1.2.3 Stormwater Runoff (Flow) and Sampling During Monitored Events

Monitoring that occurred during the 2001/02 wet season marked the second season for monitoring the CDS™ units. The minimum number of target storms (8 per site) was not met at the CDS™ units during the 2000/01 wet season. During the 2000/01 wet season, 4 storm events were sampled at the Orcas Avenue CDS™ unit and 7 storm events were sampled at the Filmore Street CDS™ unit. Therefore, monitoring was continued through the 2001/02 wet season to successfully meet the minimum number of target storms at the CDS™ sites. Monitoring was designed to isolate rainfall events and gather representative samples of the runoff created by these events that flowed into and discharged out of the CDS™ units.

- Table 1-b summarizes the flow characteristics and sampling data for each sampled storm event at the CDS™ units. The table includes start and end dates and times of flow, flow duration, peak flow, total flow, start and end dates and times of sampling, sampling duration, number of successful sample aliquots, the associated percent capture and the volume to sample at which the flow meter was set.

- Figures 1-4 through 1-10 illustrate the total flow, duration of flow, peak flow, observed runoff coefficient, composite sampling start and stop times, estimated percent storm capture, number of successful sample aliquots, time the effluent TPH and Fecal coliform grab samples were collected, as well as, if and when flow or debris bypass occurred for each sampled storm event at the Orcas Avenue CDS™ unit.

- Figures 1-11 through 1-20 illustrate the total flow, duration of flow, peak flow, observed runoff coefficient, composite sampling start and stop times, estimated percent storm capture, number of successful sample aliquots, time the effluent TPH and Fecal coliform grab samples were taken, as well as, if and when flow or debris bypass occurred for each sampled storm event at the Filmore Street CDS™ unit.

There were ten storms monitored during the 2001/02 wet season at the Orcas Avenue and Filmore Street CDS™ units. Of the ten monitored storms at the Orcas Avenue CDS™ unit, seven were sampled. There was insufficient flow in the Orcas Avenue CDS™ unit for samples to be collected during the monitored storms that occurred on October 30, 2001; December 2-3, 2001; and March 6-7; 2002. All ten of the monitored storms at the Filmore Street CDS™ unit were sampled.

Flow monitoring was conducted for each storm event at the CDS™ units. The hydraulic residence time within the CDS™ unit is short, making the influent and effluent flow rate differentials negligible. For this reason, the flow is measured only on the effluent side of the unit. Flow is measured in one-minute intervals using a bubbler sensor in conjunction with an H-flume.

Bypass was monitored using a bubbler sensor located at the base of the bypass weir. Bypass occurred on three occasions at the Orcas Avenue CDS™ unit, Event 1 (Figure 1-4), Event 2 (Figure 1-5), and Event 5 (Figure 1-8). Bypass also occurred on three occasions at the Filmore Street CDS™ unit, Event 2 (Figure 1-12), Event 3 (Figure 1-13), and Event 6 (Figure 1-16). All bypasses appeared to result from the exceedance of the CDS™ units' design flow capacity of 28.32 liters per second (L/s) [1 cubic foot per second (cfs)].

Grab samples were collected from both the influent and effluent sections of the CDS™ units during storm events. Influent grab samples were generally collected a few minutes prior to the effluent grab samples.

Composite samples were also collected from the influent and effluent sections of the CDS™ units during storm events. Due to the short hydraulic residence time and the negligible flow-rate differential between the influent and effluent sides, the bubbler sensor and the H-flume located on the effluent side triggered the influent and effluent samplers. This composite sampling procedure was considered representative for occasions when bypass occurred.

OMM protocol required that a grab sample be collected from each of the CDS™ units' sumps at least one time during the wet season. These sump grab samples were collected on February 12, 2002, at both the Orcas Avenue and the Filmore Street CDS™ units.

In addition to the 10 monitored events, there were 30 non-monitored events at the Filmore Street CDS™ unit and 34 non-monitored events at the Orcas Avenue CDS™ unit.

Of the 30 non-monitored events at the Filmore CDS™ unit, 7 events had rain of 0.05 inches or less. Most of the total non-monitored event flow was associated with events that had rainfall depths of greater than 0.05 inches. A significant portion of the total non-monitored flow, however, was associated with events that had flow but no measured rainfall. During these events, flow was measured at approximately the same time each day, suggesting that a non-storm water flow such as irrigation may have been discharging into the CDS unit. Several events had flow measured prior to any measurable rain. Possible explanations for this include potential equipment malfunctions and/or very low rainfall amounts that were not or could not be measured. These events, however, comprised a small portion of the total non-monitored event flow.

Of the 34 non-monitored events at the Orcas CDS™ unit, 27 had rain but no flow, or flow but no rain measured. Individually, these events didn't produce a significant amount of flow volume. Combined, these types of events totaled about 13,500 L of flow volume.

For events with rain but no flow, flow may not have been measured because of challenges in measuring low flows with the existing flow meters, and/or possibly due to losses within the drainage area due to infiltration and/or evaporation. For events with flow but no rain, rain may have not been measured due to equipment malfunction. Alternatively, only flow may have measured due to non-storm water discharges such as irrigation flows. Of the 34 events, 7 had rain and flow measured. Of these 7, only one event (non-monitored event 17) had rainfall of less than 0.05 inches. Flow may have occurred during this event (versus other events with little rain, but no flow) because an earlier storm may have saturated the ground. The largest non-monitored event occurred on January 15th and resulted in a total flow volume of 16,909 L.

1.3 Analytical Results

The following sections provide an assessment of the overall quality of the data set, a summary of water quality data for each monitored event, and solids sampling results.

1.3.1 Assessment of Quality Assurance / Quality Control (QA/QC) Results

Prior to determining the CDS™ units' performance, laboratory reports were reviewed and the data validated for overall precision, accuracy, representative characteristics, and completeness to establish data quality and usability. As part of this process, field and laboratory quality control (QC) data was assessed for compliance with the procedures and methods outlined in the *Quality Assurance Project Plan (QAPP)* presented in *Appendix III of the Operation, Maintenance, and Monitoring (OMM) Plan*. QC samples were collected during the 2001/02 wet season. Prior to each rain event a QC schedule was developed to determine the type of QC samples to be collected at each site in a manner to satisfy the requirements outlined in the OMM Plan - Quality Assurance Project Plan. Given the constraints associated with the collection of stormwater samples, the QC schedule was designed to be flexible in case sufficient sample was not obtained from the designated QC station. Table 1-c summarizes the QC samples collected during each monitored storm event.

The data quality indicators used to evaluate the overall usability of the data for meeting the project Data Quality Objectives (DQOs) are described in the following paragraphs.

Precision

Precision measures the reproducibility of individual measurements under a given set of conditions. Precision was evaluated for each analyte based on field and laboratory duplicates. Field duplicate analyses were used to measure both field and laboratory precision, and to make an overall judgment as to whether the contaminants detected in the environmental samples are representative of conditions at the BMP location where the field duplicate was collected. Laboratory duplicates were used to demonstrate method precision at the time of the analyses. Overall precision was evaluated in terms related to the mean concentration (relative percent difference). The relative percent difference (RPD) between the pair of samples was calculated using the following formula:

$$\%RPD = \left[\frac{[S - D]}{\left[S + \frac{D}{2}\right]} \right] \times 100$$

Where:

S = first sample value
D = duplicate sample value

Analytical results and the associated RPD results for both field duplicates and laboratory replicates are presented in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters.

Accuracy

Accuracy measures the bias in a measurement system by the degree of agreement between a measured value and an accepted reference or true value. The accuracy of the analytical determinations was evaluated using laboratory QC analyses such as laboratory control samples (LCS), matrix spikes (MS/MSD), and surrogate spikes (where applicable). Accuracy results for the LCS analyses were used to monitor the overall performance of all steps in the analysis, including sample preparation. Matrix spike accuracy data was used to provide information about the effect of each sample matrix on the preparation and analyses methodology. Surrogate spike recovery results (where applicable) were used to establish if the analytical method was performed properly. Accuracy is expressed as the percent recovery of a known concentration added and the measured concentration as shown in the following formula:

$$\%Recovery = \left[\frac{(S - U)}{C_s} \right] \times 100$$

Where:

S = Measured concentration of spiked aliquot
U = Measured concentration of un-spiked aliquot
C_s = Concentration of spike added

Accuracy results are reported by the laboratory and are presented along with the associated analytical results in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters.

Representative Characteristics

Representative characteristics express the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Sample representative characteristics

were assessed in terms of percent storm captured, number of aliquots, and ultimately the evaluation of all associated blanks. Sample integrity was also evaluated with respect to adherence to the required preservation, storage, and holding times. A discussion of samples not meeting percent storm capture and/or minimum number of aliquots goals is discussed below. Blank results and adherence to holding times are discussed in the Data Validation Results Section 1.3.1.3.

The OMM Plan defines a representative composite sample as being composed of a minimum of 12 aliquots and representing at least 75 percent storm capture. A summary of the number of aliquots collected and percent storm capture for the monitored events at both CDS™ units is provided in Table 1-d.

At the Orcas Avenues CDS™ unit, all samples met the 75% minimum storm capture goal with the exception of the effluent sample for Event 5 (Figure 1-8). Based on the data collected the estimated percent capture was 64% for the effluent sample during Event 5. The minimum number of aliquots (12) was also met during all the monitored events with the exception of one. The automated sampler at both the influent and effluent sampling locations collected only 4 aliquots during Event 3 (Figure 1-6). This composite sample was discarded due to lack of volume. However, TPH and Fecal coliform grab samples were collected during Event 3. Therefore, a hydrograph was created to represent the hydrologic characteristics of the event. Overall, the average percent storm capture at Orcas Avenue CDS™ unit was greater then 90%.

At the Filmore Street CDS™ unit, all samples met the 75% minimum storm capture goal. There were two events that did not capture the minimum number of aliquots: Event 1 (Figure 1-11) and Event 9 (Figure 1-19). Event 1 only captured 6 aliquots at the influent and effluent sampling locations, and only 7 aliquots were captured at the influent and effluent sampling locations during Event 9. The estimated percent storm capture was 96% for Event 1 and 99% for Event 9. Although they do not meet the criteria for minimum number of aliquots, these two samples aliquots were well distributed and flow-weighted across the hydrograph. It is recommended that both sample results be accepted.

Completeness

Completeness is a measurement of the amount of valid data obtained from a measurement system compared to the amount that was expected under normal conditions. Completeness was determined based on validation results and the number of valid data points (not rejected) relative to the total number of validated data. The overall completeness objective of 95 percent was met for all parameters. Percent completeness was calculated using the following formula:

$$\%Completeness = \left(V \diagup T\right) \times 100$$

Where:

V = number of valid data points

T = total number of planned measurements

1.3.1.1 Field QA/QC

Blanks

Composite bottles and tubing were decontaminated in accordance with the procedures specified in the OMM Plan. All blanks were prepared in accordance with the project specifications as outlined in the OMM Plan - Quality Assurance Project Plan. Blank sample results were evaluated to determine whether contamination was introduced as a result of sample equipment contribution (tubing blanks and composite bottle blanks) and analytical procedures (filter blanks and method blanks). Composite bottles (batches of 20) were not released for use unless blanks showed no contamination (i.e., blank results less than Reporting Limits). A review of this data showed that there were no contamination issues (i.e., all blank results were less than the Reporting Limits).

Field Duplicates

As shown in Table 1-c, field duplicate samples were collected during storm events, a total of four were collected for the composite samples and seven were collected for the TPH and Fecal coliform grab samples. These samples were submitted "blind" to the laboratory and analyzed for the full list of analytes associated with grab and composite samples. Precision data, as measured by the RPD, was calculated for all parameters reported above the Reporting Limit and are presented in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters.

There are no review criteria for field duplicate analyses comparability. It is expected that the results may have more variability than laboratory replicates, which measure only laboratory performance. It is likely that the RPD observed in samples is due to the heterogeneity of the samples.

1.3.1.2 Laboratory QA/QC

To achieve the data quality needed to support project DQOs, all analyses for this investigation were performed using laboratory procedures in accordance with specified analytical protocols. To ensure comparability of the results and to maintain a high level of QC, a laboratory certified by the State of California under the Environmental Laboratory Accreditation Program (ELAP) performed the analyses.

The subsections below describe how each laboratory QC parameter was assessed for compliance with method-specific requirements. The results of this evaluation with respect to the data validation criteria are discussed in Section 1.3.1.3.

Method Blanks

A method blank was included in every analytical batch of twenty samples or less to demonstrate that the laboratory materials and environment were not introducing

contamination to the analysis. Sample concentrations associated with method blanks containing target analytes were evaluated with respect to blank concentrations during data validation to determine the need for qualification.

Laboratory Control Samples (LCS)

One LCS was prepared with each analytical batch of 20 samples or less. The LCS is a laboratory prepared blank to which a known concentration of all of the target analytes is added. The LCS was carried through the entire sample preparation and analysis procedure along with the field samples. LCS recoveries were used to demonstrate that the method is operating within acceptable limits. LCS accuracy results were evaluated with respect to the acceptance criteria specified in the QAPP.

Laboratory Replicates

As shown in Table 1-c, four composite samples, four TPH and four Fecal coliform grab samples collected during storm events were assigned for laboratory replicate analyses for the full list of analytes. The laboratory split these samples. Each aliquot of the sample was then analyzed and reported. Precision data as measured by the RPD was calculated for all parameters reported above the Reporting Limit and are presented in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters. Precision data generated from laboratory replicates were evaluated during data validation with respect to the control limits specified in the QAPP. Laboratory replicates with RPD limits outside the validation criteria and with both sample concentrations greater than 5x the RDL were flagged as estimated "J" for all samples analyzed within that batch.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

One set of a matrix spike/matrix spike duplicate (MS/MSD) was prepared and analyzed for every analytical batch of 20 samples or less. As shown in Table 1-c, MS/MSD analyses were performed on four composite samples and five TPH grab samples. There were no MS/MSD analyses of the Fecal coliform grab samples. In this process, three sample aliquots were measured out, and a known amount of the target analyte(s) was spiked into two of the aliquots at the same concentration. The three portions were then prepared and analyzed in the same manner. The analysis of the two spiked aliquots generated recovery data, which was used to measure the effects of interferences in the sample matrix and to reflect the overall accuracy of the determination. Additionally, the calculated RPD between the two measurements were used to assess matrix-specific precision. The selection of spiking analytes was consistent with the published method. Matrix spike accuracy and precision results were evaluated during data validation with respect to the control limits specified in the QAPP.

Surrogates

Surrogate standards were added to all samples and QC samples tested by gas chromatography (GC). Surrogates are non-target compounds that are analytically similar

to the analytes of interest. The surrogate compounds are spiked into the sample prior to the extraction or analysis. Surrogate recoveries were evaluated with respect to the acceptance criteria specified in the QAPP.

Holding Times

The holding time is the maximum amount of time that samples may be held before analysis for the results to be considered valid. Any holding time exceeded is listed in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters.

Reporting Limits

Analytical methods and associated Reporting Limits specified in the OMM Plan were adhered to. Refer to Table 1-e for the Analytical Method and its associated Reporting Limit.

1.3.1.3 Data Validation

The following sections present data validation performed to evaluate the usability of the sample data for meeting the project objectives.

Verification and Review

The verification and review process is based on overall accuracy, precision, and representative characteristics to establish data quality and usability. The approach used in the validation process involved the review of chain-of-custody forms; preparation and use of checklists that detail the required QC for each respective analytical method; verification and documentation of compliance with the applicable criteria and, assignment of qualifiers to sample results associated with QC samples that do not meet the validation criteria. The Caltrans Automated Data Validation (ADV) software performed data validation. The evaluation of whether or not qualification of the data is deemed necessary followed basic guidelines from the United States Environmental Protection Agency (EPA) for evaluating inorganic and organic analysis (EPA, February 1994a; EPA, 1994b).

Each Electronic Data Deliverable (EDD) received from the laboratory was imported into the ADV software. Samples reported in the EDD as field QC samples, such as field duplicates were assigned a field QC type and associated to “true” field samples. After making field QC assignments, the EDD was ready for automated validation. A project library meeting the project specifications as outlined in the OMM Plan - Quality Assurance Project Plan was selected, and then the automated validation routine was executed. During validation, all laboratory quality control results reported in the EDD were compared against the library criteria. When a quality control result exceeded limits established in the library, a validation flag was appended to the result records in all samples associated to that quality control sample. Holding times were also evaluated from sampling to analysis, sampling to extraction, and extraction to analysis dates, whichever applied. Method blanks

were evaluated and if target analytes were reported in blanks, appropriate qualifiers were appended to analyte result records for samples associated to those blanks.

Data Qualifiers

U	Indicates the compound or element was an analyte, but was not detected at or above the contract required detection limit (RDL).
J	Indicates an estimated value.
R	Indicates that QC determined the data are not usable.
UJ	Indicates the compound or element was analyzed, but was not detected; the sample detection limit is an estimated value.

Data Validation Results

Analytical results and associated data qualifiers are summarized in Table 1-f. The ADV software provided validation summary reports, which are included in the Appendix Document A: Quality Control Summary Report for 2002 Storm Waters. These included validation reports on a sample basis and Quality Control Outlier reports for each quality control element. Quality Control Outlier reports list results for quality control samples that have outliers (values exceeding library criteria). Quality Control Outlier reports include a list of all samples and constituents reported in those samples associated to the affected quality control sample. Library validation criteria for the affected constituent are also included in the Quality Control Outlier reports.

1.3.2 Water Quality Sampling Results

Analyses were conducted on stormwater samples by a laboratory certified under the California Environmental Laboratory Accreditation Program (ELAP). The analyses were performed in accordance with methods and procedures outlined in the OMM Plan - Quality Assurance Project Plan and as specified by applicable EPA methods. The laboratory analytical methods performed on stormwater samples are listed in Table 1-e.

Grab samples collected during storm events were analyzed for organic pollutants [Total Petroleum Hydrocarbons (Diesel, Gasoline and Heavy Oil)] and microbial pollutants (Fecal coliform).

Composite samples collected during storm events were analyzed for, conventional pollutants (Dissolved Organic Carbon, Specific Conductance, Hardness as $CaCO_3$, Percent Hydrogen, Total Dissolved Solids, Total Organic Carbon, Total Suspended Solids), total/dissolved metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc) and nutrients (Nitrate as Nitrogen, Total Phosphorous, Dissolved Ortho-Phosphate, Total Kjeldahl Nitrogen).

The sump grab sample collected during the wet season from each CDS™ unit was analyzed for organic and microbial pollutants, as well as, conventional pollutants, total/dissolved metals and nutrients.

The analytical results for the grab and composite samples collected during storm events and the sump grab samples collected during the wet season, are summarized in Table 1-f.

1.3.3 Waste Sampling Results

Gross pollutants (litter and vegetation) were cleaned out from the Orcas Avenue CDS™ unit weir box, sump, and bypass bag five times and from the Filmore Street CDS™ unit once during the 2001/02 season. The gross pollutants were disposed of as non-hazardous solid waste.

During the final cleanout of the Filmore Street CDS™ unit on April 25, 2002, and the Orcas Avenue CDS™ unit on May 6, 2002, the residual storm water from the sumps was pumped into drums for temporary storage on-site. A composite sample was collected from each site by obtaining grab samples from each of the drums and combining them to form one sample per site for analysis. The composite sample was collected from the drums for waste disposal characterization. The waste sampling analytical methods, reporting limits, and waste matrix (Disposal) for the CDS™ units are provided in Table 1-g. The waste sampling analytical results are summarized in Table 1-h. Based on the composite waste sampling analysis compared to California Code of Regulations Title 22 hazardous waste criteria, it was deemed that the sump water removed from both of the CDS™ units during the final cleanouts was non-hazardous waste.

1.4 CDS™ Performance Evaluations

The performance evaluations of the Orcas Avenue and Filmore Street CDS™ units consisted of characterizing the types and amounts of gross pollutants captured within the CDS™ units and calculating removal efficiencies for gross pollutants, individual water quality constituents, and inorganic (non-volatile) solids.

1.4.1 Gross Pollutants

Gross pollutants include settleable and floatable debris (litter and vegetation) that are captured within and bypass a CDS™ unit. Gross pollutants were removed from the CDS™ units during cleanouts and characterized by volume, mass, and type. This characterization also provided information to calculate gross pollutant removal efficiencies.

1.4.1.1 Characterization

Gross pollutants (floatable debris, settleable debris, and bypass debris) were collected from the units when the thresholds per the MID were met. The floatable debris, settleable debris, and bypass debris were held in separate containers. The containers were delivered to a litter characterization laboratory.

At the laboratory, the gross pollutants were then characterized as either litter or vegetation. To obtain an estimated value of the gross pollutants, a wet volume and weight were then

measured. After drying the characterized gross pollutants for 72 hours, a dry volume and weight were again estimated (measured). The data collected from this procedure is referred to as the Gross Pollutant Characterization.

Note that the volumes measured typically increase through the characterization process due to expansion of the gross pollutants during separation and drying. For example, Figure 1-61 the Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001 has an Estimated Gross Pollutant Wet Volume reported as 28 liters. This value is obtained when the pollutants are first removed from the CDS™ unit, and before the Gross Pollutant Characterization. At this time, the pollutants are compressed and moist. In Figure 1-21, the Gross Pollutant Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001, the value reported for the Estimated Wet Volume Captured is 32 liters. The value reported for the Estimated Dry Volume Captured is 43 liters. The process of separating the litter and characterizing it as either litter or vegetation expands the volume of the wet pollutants. The volume expands further after the pollutants are dried because the gross pollutants are spread out in drying pans, dried, and then placed in graduated cylinders for re-measurement.

After the Gross Pollutant Characterization was completed, the litter was separated by type. The volumes and weights of the separated litter were measured and each piece counted. The data collected from this procedure is referred to as the Gross Litter Characterization. Upon completion of the Gross Litter Characterization, the gross pollutants were disposed of as non-hazardous solid waste.

Gross Pollutant Characterization and Gross Litter Characterization were performed for the cleanouts of the Orcas Avenue CDS™ unit on November 19, 2001; November 28, 2001; January 9, 2002; and January 30, 2002.

- The Gross Pollutant Characterization for the November 19, 2001, cleanout is presented on Figure 1-21. The Gross Litter Characterization for the November 19, 2001 cleanout is presented on Figures 1-22 through 1-24.

- The Gross Pollutant Characterization for the November 28, 2001, cleanout is presented on Figure 1-25. The Gross Litter Characterization for the November 28, 2001, cleanout is presented on Figures 1-26 through 1-40.

- The Gross Pollutant Characterization for the January 9, 2002, cleanout is presented on Figure 1-41. The Gross Litter Characterization for the January 9, 2002, cleanout is presented on Figures 1-42 through 1-44.

- The Gross Pollutant Characterization for the January 30, 2002, cleanout is presented on Figure 1-45. The Gross Litter Characterization for the January 30, 2002, cleanout is presented on Figures 1-46 through 1-54.

Neither Gross Pollutant nor Gross Litter Characterizations were performed on debris collected during the final cleanouts of the Filmore Street CDS™ unit on April 25, 2002, and the Orcas Avenue CDS™ unit on May 6, 2002. A modified procedure done for the first time this year was followed during these final cleanouts. This procedure was designed to estimate the amount of solids captured by the CDS™ units and to calculate solids removal efficiencies for each CDS™ unit via a mass balance approach. This modified procedure is summarized below and outlined in a flow chart format in Figures 1-55 through 1-60.

In summary, the modified procedure consisted of first collecting floatable debris, settleable debris, and bypass debris in separate containers during the April 25, 2002 Filmore Street CDS™ unit cleanout and the May 6, 2002 Orcas Avenue CDS™ unit cleanout. Also, sump sediment/sludge was collected from both CDS™ units. The sump sediment/sludge was collected in a separate container during the Filmore Street CDS™ unit cleanout. The sump sediment/sludge was combined with the settleable debris during the cleanout of the Orcas Avenue CDS™ unit. Also at the Filmore Street CDS™ unit, annular space sediment/sludge was collected in a separate container. The annular space is the gap between the inner wall of the CDS unit and the basket within the unit. Annular space sediment/sludge was not collected at the Orcas Avenue CDS™ unit because signs of overflow from the top of the basket were observed. This observation suggests that the annular space sediment/sludge would not be representative of what was filtered through the basket filter fabric.

Wet weights of each gross pollutant were measured. After drying for 72 hours, dry weights of each gross pollutant were measured. After measuring the dry weights, the gross pollutants (or representative samples of gross pollutants) were incinerated. Incineration was conducted to estimate the amount of solids entrained in the gross pollutants.

Incineration procedures consisted of placing the load or sample in a ceramic kiln or igniter oven. The kiln or oven was heated to above 500 degrees Celsius to burn off organic material and carbon ash. Organic material and carbon ash were assumed removed when the mass of the material stopped decreasing, leaving inorganic sediment and ash. Table 1-i presents the measured weights for each incinerated load and sample.

1.4.1.2 Removal Efficiencies

The efficiency of the CDS™ unit as a gross pollutant trap was calculated. Gross pollutant removal efficiencies are represented by percent mass and volume captured versus percent mass and volume bypassed, as illustrated on Figures 1-61 through 1-66. The results are based on five cleanouts of the Orcas Avenue CDS™ unit and one cleanout of the Filmore Street CDS™ unit.

1.4.2 Water Quality

Water quality removal efficiencies were calculated for the following pollutants: conventional (Total Dissolved Solids, Total Suspended Solids, Dissolved Organic Carbon, Total Organic Carbon), total/dissolved metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc) and nutrients (Nitrate as Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorous, Dissolved Ortho-Phosphate).

The water quality pollutant removal efficiencies were calculated based upon Event Mean Concentrations (EMCs) and load estimates measured at the influent and effluent monitoring sites for each CDS™ unit. The following equations were used to calculate water quality removal efficiencies for each storm event:

$$Efficiency(\%) = \left[\left(EMC\ in - EMC\ out \right) \Big/ EMC\ in \right] \times 100$$

$$Efficiency(\%) = \left[\left(LOAD\ in - LOAD\ out \right) \Big/ LOAD\ in \right] \times 100$$

Average wet season efficiencies based on loads were calculated using the Scoping Study Methodology.

The Scoping Study Methodology consists of calculating average water quality removal efficiencies for the wet season by calculating the natural log mean influent and effluent EMCs, and then calculating pollutant loads based on these mean EMCs, the total wet season flow at each CDS™ unit (for both monitored and non-monitored events), and a 90% confidence interval.

The CDS™ units' water quality pollutant removal efficiencies for the 2001/02 wet season calculated using the Scoping Study Methodology are presented in Tables 1-k through 1-m and illustrated in Figures 1-67 through 1-74. The water quality pollutant removal efficiency for the two-year study period (2000/02), calculated using the Scoping Study Methodology, is presented in Table 1-n.

Note that the Scoping Study Methodology calculates the average water quality removal efficiencies assuming a log normal distribution of water quality results. The Shapiro-Wilk W Test was performed on the data sets for each constituent at both the influent and effluent for the CDS™ Units to determine if they were log normally distributed. All data sets were log normally distributed except those listed in Table 1-o.

1.4.3 Inorganic (Non-Volatile) Solids

Due to possible autosampler limitations in capturing solids in stormwater, particles larger than 100-125 microns and solids entrained in vegetation and litter may not be captured by the influent and effluent autosamplers and may not be accounted for in the TSS Removal

efficiency calculations. Therefore, modified cleanout, gross pollutant characterization, and removal efficiency calculation procedures were used to estimate solids removal efficiencies using a Mass Balance Approach (refer to Appendix Document B: CDS™ Technologies Inc., BMP Operation, Maintenance and Monitoring Plan (Plan) - CDS™ Units, letter dated August 31, 2000).

This section focuses on estimating solids, versus TSS, removal efficiencies because of the uncertainty of whether the larger particles and solids entrained in the vegetation and litter would be considered as TSS.

The modified cleanout and gross pollutant characterization procedures conducted for the final cleanouts of the Orcas Avenue and Filmore Street CDS™ units are described in Section 1.4.1.1. Based on the results of these characterization procedures, weights of incinerated captured and bypassed solids were obtained.

The following equation was used to calculate inorganic (non-volatile) solids removal efficiencies for each CDS™ unit. These removal efficiencies are considered non-volatile removal efficiencies because the Separation Chamber and Bypass Loads are based on the masses of non-volatile solids measured after incineration. Volatile solids were burned off during incineration, leaving non-volatile solids (non-volatile sediment, inorganic ash, and other non-volatile solids).

$$Efficiency(\%) = \left[\frac{Separation\,Chamber\,Load}{(Outlet\,Load + Separation\,Chamber\,Load + Bypass\,Load)} \right] \times 100$$

Separation Chamber Load = Sump Water Load + Sump Sediment/Sludge Load + Sump Basket (litter and vegetation) Load

Where,

Sump Water Load = Sump Volume x *Sump Water Pollutant Concentration*

Sump Basket Load = $\sum$ *Individual Cleanout Incinerated Settleable and Floatable Weights*

Outlet Loads = Effluent load calculated per the Scoping Study Methodology

Bypass Loads = $\sum$ *Individual Cleanout Incinerated Bypass Weights*

Table 1-j presents the estimated separation chamber loads for each cleanout based on the incineration results in Table 1-i.

Based on the separation chamber loads presented in Table 1-j, the following is the inorganic (non-volatile) solids removal efficiency for the Orcas Avenue CDS™ unit.

Separation Chamber Load = 6,366 g
Outlet Load = 12,755 g
Bypass Load = 32 g

Efficiency = 33 %

Based on the separation chamber loads presented in Table 1-j, the following is the inorganic (non-volatile) solids removal efficiency for the Filmore Street CDS™ unit:

Separation Chamber Load = 31,164 g
Outlet Load = 62,146 g
Bypass Load = 90 g

Efficiency = 33 %

The bypass load was calculated by multiplying the calculated percent inorganic fraction (0.26) of the Filmore Street CDS™ Unit Floatables Subsample shown in Table 1-i times the dry mass of bypass matter collected during the cleanout of the Orcas Avenue CDS™ unit on November 28, 2001 and the final cleanout of the Filmore Street CDS™ unit on April 25, 2002.

Note that the Separation Chamber and Bypass Loads represent non-volatile solids loads, versus combined non-volatile and volatile (organic) loads. Volatile solids were burned off during incineration, leaving non-volatile solids (non-volatile sediment, inorganic ash, and other non-volatile solids). The percentage of volatile solids burned off in the sediment is unknown. However, a subsample of mostly sediment material collected at the annular space (exterior of the screen) at the Filmore CDS™ unit had an estimated volatile solids content of 18 percent. The Filmore CDS™ unit had a large tar component, which may have contributed to the 18 percent volatile solids measurement.

While the Separation Chamber and Bypass Loads represent non-volatile solids loads, the Outlet Loads represent combined non-volatile and volatile loads. The Outlet Loads are based on TSS effluent concentrations measured by autosamplers. TSS contains both non-volatile and volatile solids. If the volatile solids fraction of sediment in the Separation Chamber and Bypass Loads were accounted for in the removal calculations, the combined volatile and non-volatile removal efficiencies would be slightly higher than the efficiencies calculated above for only non-volatile solids.

Also note that the mass of inorganic ash remaining from the incineration of larger organic and inorganic debris is included, which may not typically be considered as non-volatile solids. Although the mass of inorganic ash is unknown, it is anticipated to be relatively small.

Figure 1-1

Locations of CDS™ Units within Caltrans District 7

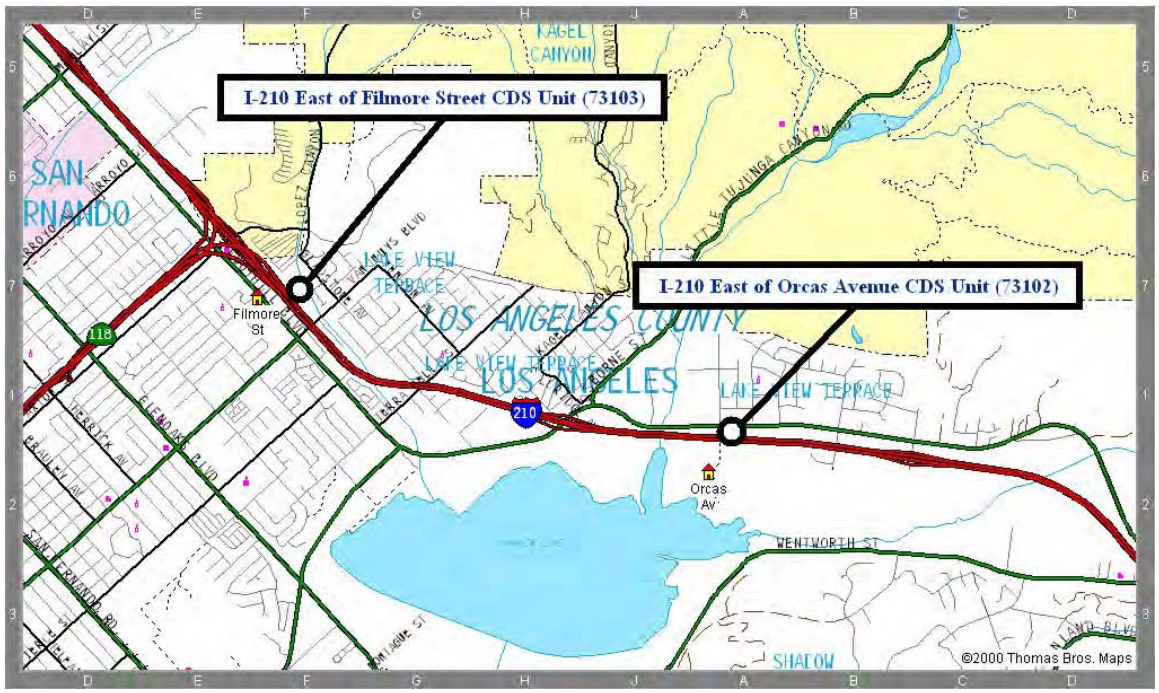
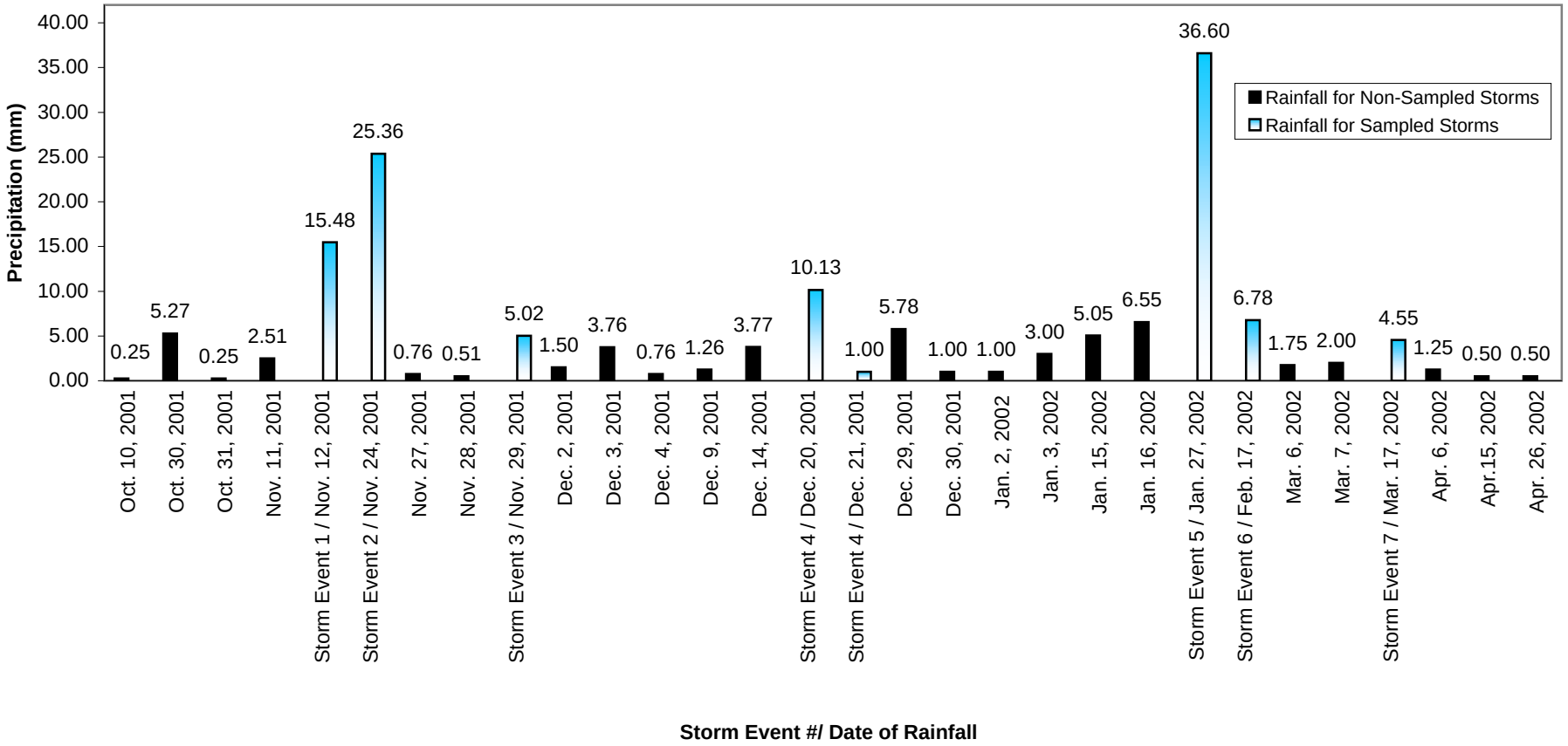
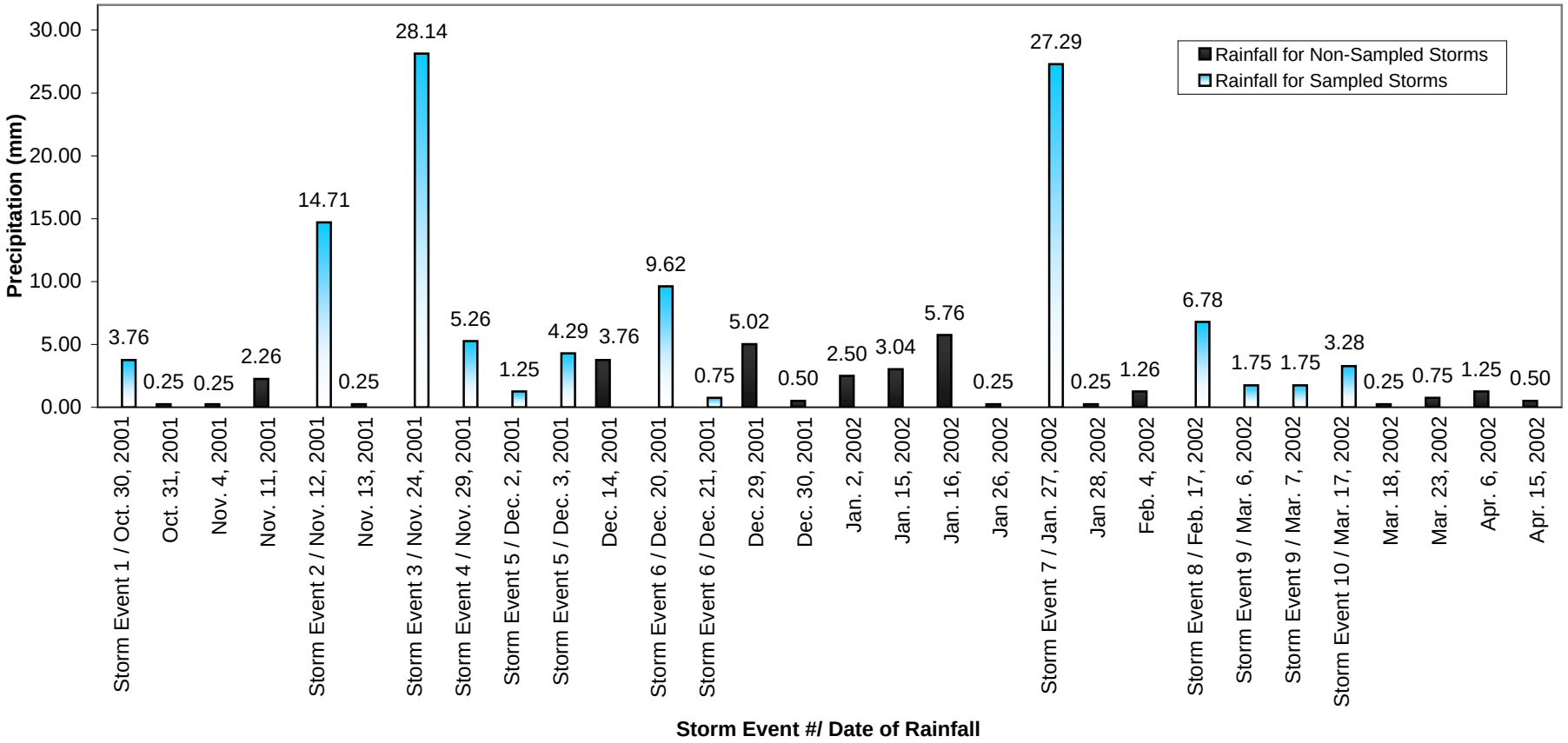


Figure 1-2
Daily Precipitation Totals for the Orcas Avenue CDS™ Unit



The daily precipitation values for the Orcas Avenue CDS™ unit shown in Figure 1-2 represent the total rainfall for a 24 hour period. These values may not coincide with the "Event Rain" values shown in the hydrographs for the Orcas Avenue CDS™ unit (Figures 1-4 through 1-10) due to the definition of a Caltrans Storm Event. A Caltrans Storm Event is defined on page 1-2 of this report.

Figure 1-3
Daily Precipitation Totals for the Filmore Street CDS™ Unit

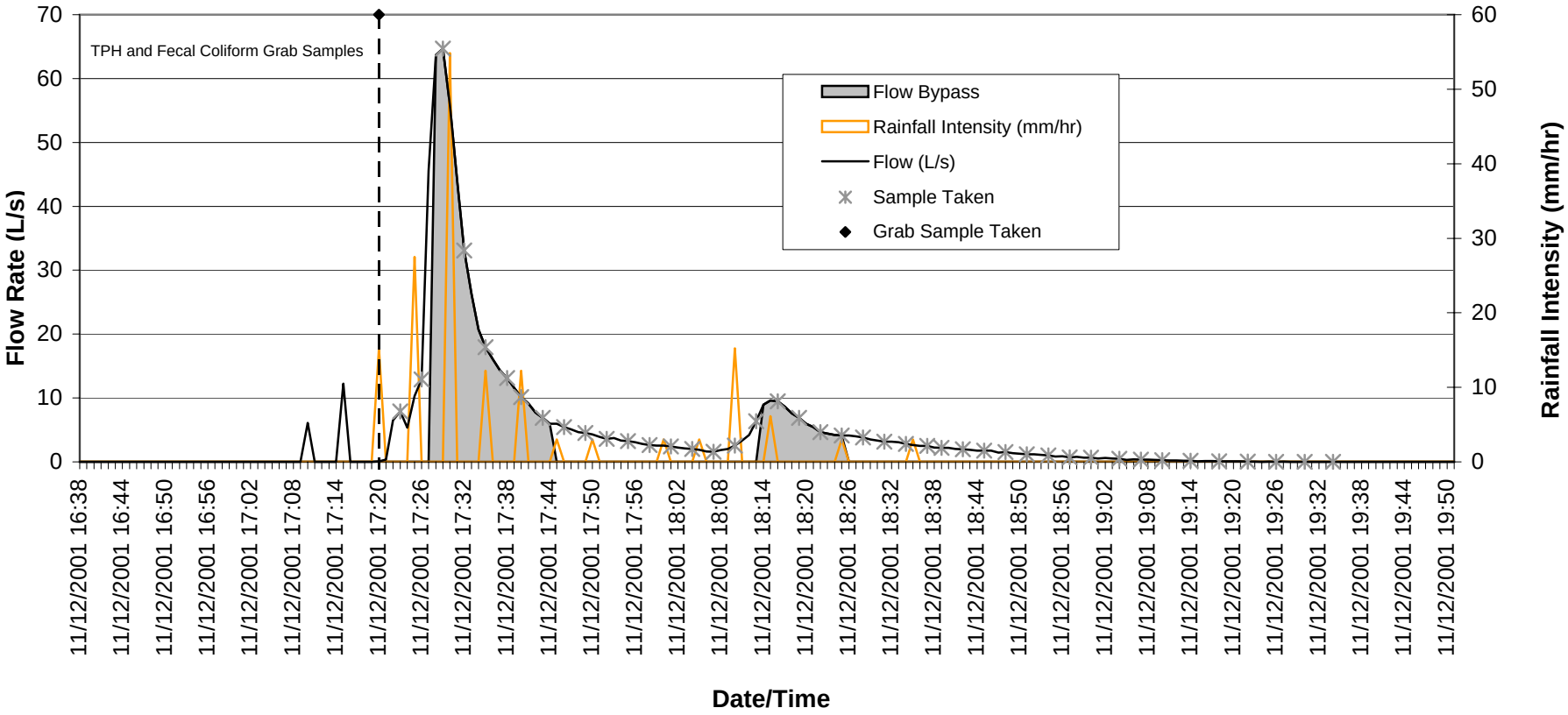


The daily precipitation values for the Filmore Street CDS™ unit shown in Figure 1-3 represent the total rainfall for a 24 hour period. These values may not coincide with the "Event Rain" values shown in the hydrographs for the Filmore Street CDS™ unit (Figures 1-11 through 1-20) due to the definition of a Caltrans Storm Event. A Caltrans Storm Event is defined on page 1-2 of this report.

Figure 1-4

Orcas Avenue CDS™ Unit
Event: 1

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	11/12/01 15:55
Stop Date/Time:	11/12/01 18:35
Event Rain (mm):	15.23
Max Intensity (mm/hr):	54.84

Runoff Data

Start Date/Time:	11/12/01 17:20
Stop Date/Time:	11/12/01 19:35
Total Flow Volume (L):	45757
Peak Flow (L/s):	64.71
Observed Runoff Coefficient:	0.668

Sample Data

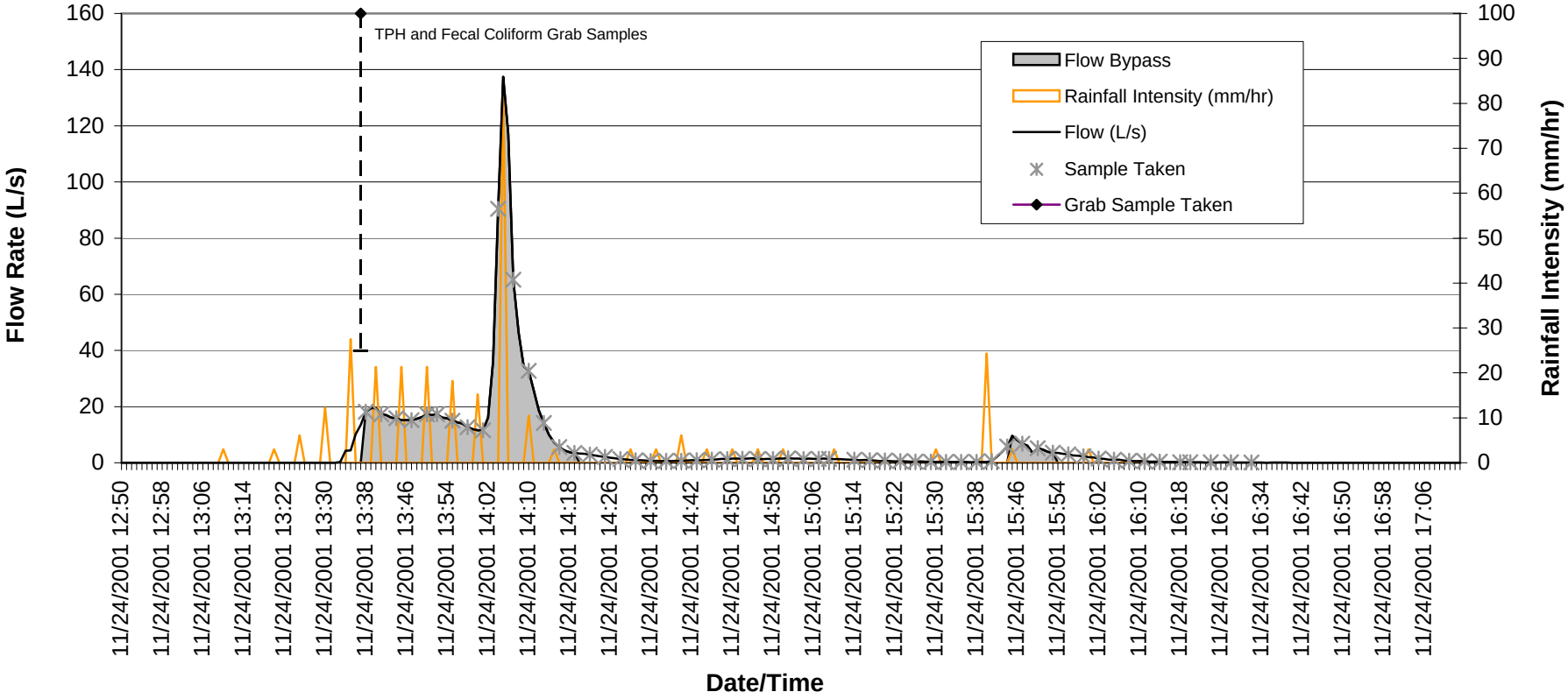
Start Date/Time:		11/12/01 17:20
Stop Date/Time:		11/12/01 19:34
Effluent:	Estimated Percent Capture:	94%
	Successful Aliquots:	42
Influent:	Estimated Percent Capture:	100%
	Avg. Successful Aliquots/Bottle:	21

Notes: Flow and debris bypass occurred.

Figure 1-5

Orcas Avenue CDS™ Unit
Event: 2

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	11/24/01 13:10
Stop Date/Time:	11/24/01 16:00
Event Rain (mm):	25.36
Max Intensity (mm/hr):	82.32

Runoff Data

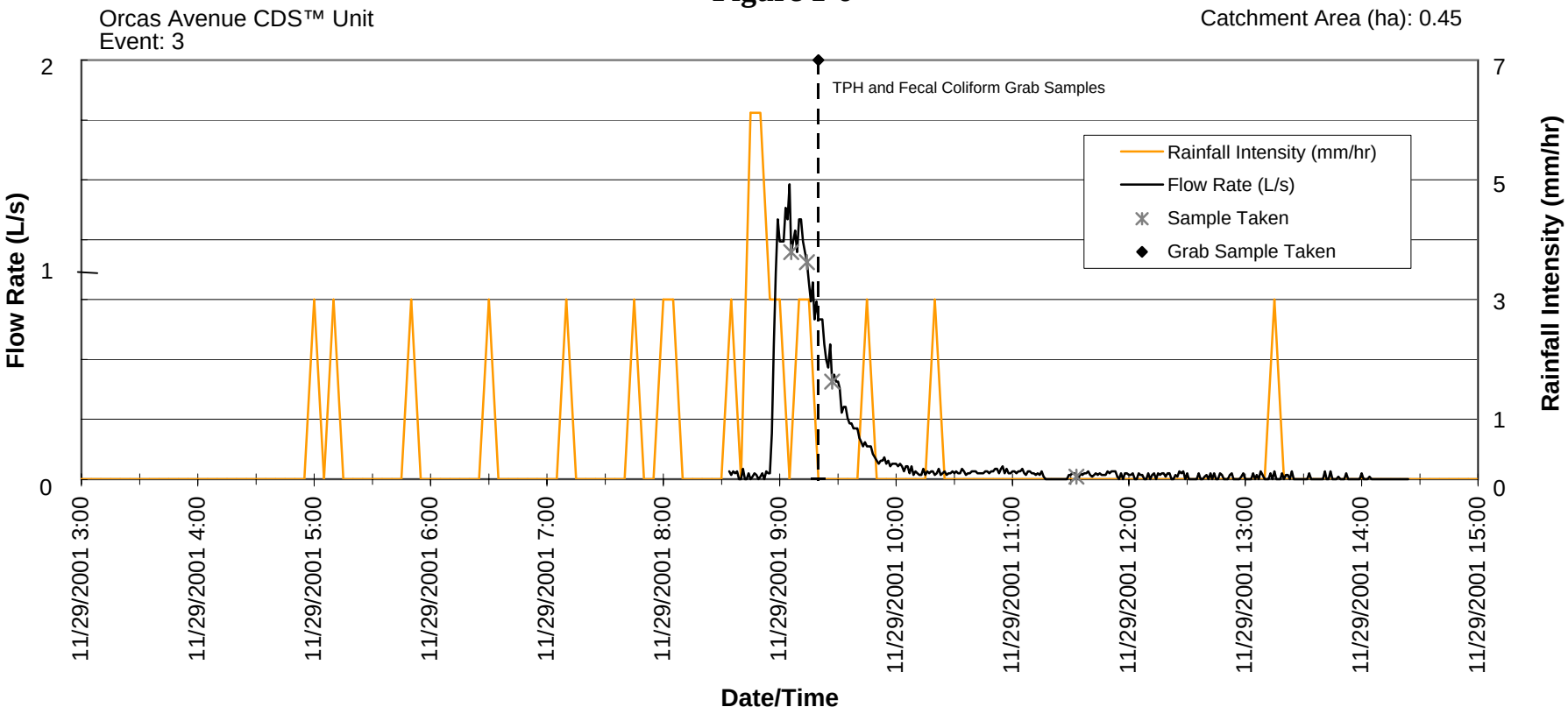
Start Date/Time:	11/24/01 13:33
Stop Date/Time:	11/24/01 17:14
Total Flow Volume (L):	75912
Peak Flow (L/s):	137.42
Observed Runoff Coefficient:	0.665

Sample Data

Start Date/Time:		11/24/01 13:33
Stop Date/Time:		11/24/01 16:34
Effluent:	Estimated Percent Capture:	99%
	Avg. Successful Aliquots/Bottle:	58
	Max. Successful Aliquots (Bottle#2):	59
Influent:	Estimated Percent Capture:	100%
	Avg. Successful Aliquots/Bottle:	52
	Max. Successful Aliquots (Bottle#1):	53

Notes: Flow and debris bypass occurred.

Figure 1-6



Rain Data

Start Date/Time:	11/29/01 05:00
Stop Date/Time:	11/29/01 13:15
Event Rain (mm):	5.02
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	11/29/01 08:34
Stop Date/Time:	11/29/01 14:25
Total Flow Volume (L):	2515
Peak Flow (L/s):	1.41
Observed Runoff Coefficient:	0.111

Sample Data

Start Date/Time:	11/29/01 08:34
Stop Date/Time:	11/29/01 11:37

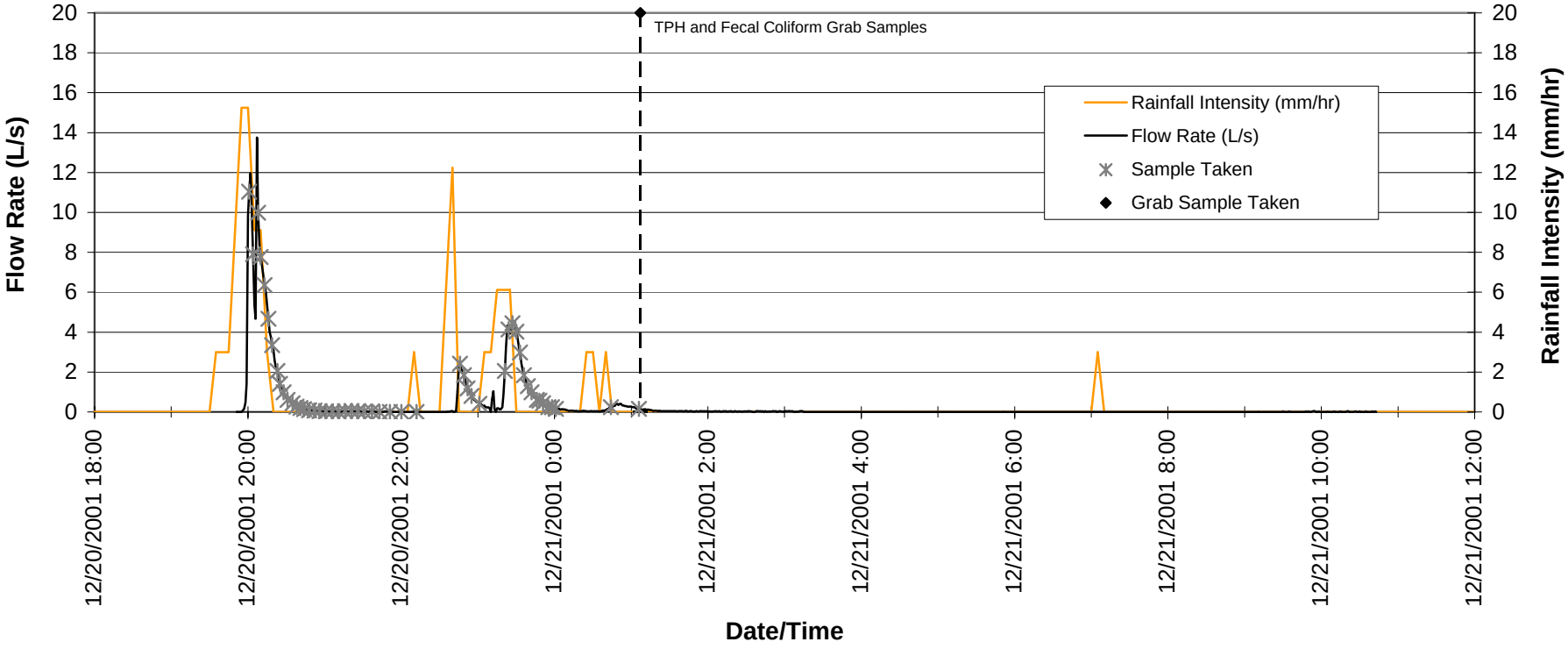
Effluent:	Estimated Percent Capture:	96%
	Successful Aliquots:	4
Influent:	Estimated Percent Capture:	95%
	Successful Aliquots:	4

Notes: Insufficient number of aliquots; composite sample not analyzed. However, grab samples were analyzed. No flow or debris bypass.

Figure 1-7

Orcas Avenue CDS™ Unit
Event: 4

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	12/20/01 19:35
Stop Date/Time:	12/21/01 00:40
Event Rain (mm):	10.38
Max Intensity (mm/hr):	15.24

Runoff Data

Start Date/Time:	12/20/01 19:51
Stop Date/Time:	12/21/01 10:44
Total Flow Volume (L):	17366
Peak Flow (L/s):	13.75
Observed Runoff Coefficient:	0.372

Sample Data

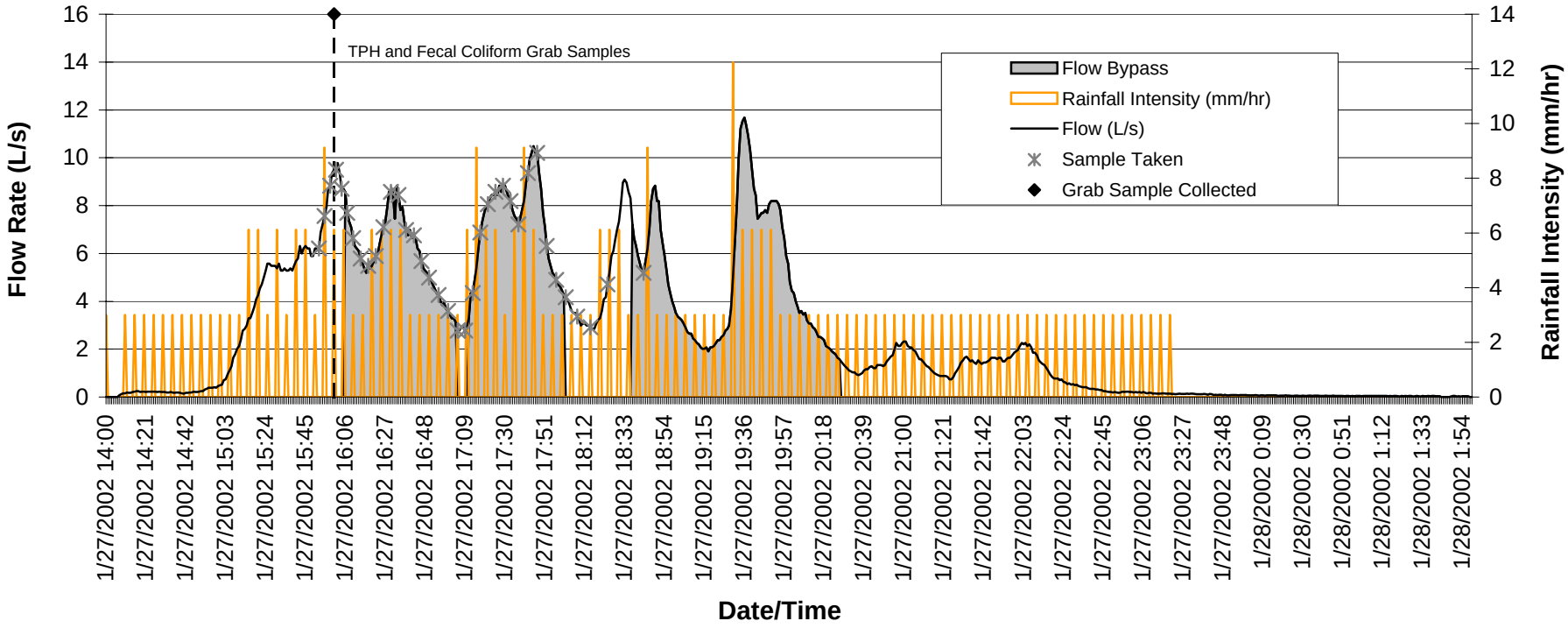
Start Date/Time:		12/20/01 19:51
Stop Date/Time:		12/21/01 01:07
Effluent:	Estimated Percent Capture:	98%
	Successful Aliquots:	51
Influent:	Estimated Percent Capture:	98%
	Successful Aliquots:	41

Notes: No flow or debris bypass.

Figure 1-8

Orcas Avenue CDS™ Unit
Event: 5

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	01/27/02 14:00
Stop Date/Time:	01/27/02 23:15
Event Rain (mm):	36.29
Max Intensity (mm/hr):	12.24

Runoff Data

Start Date/Time:	01/27/02 14:00
Stop Date/Time:	01/28/02 02:00
Total Flow Volume (L):	120789
Peak Flow (L/s):	11.68
Observed Runoff Coefficient:	0.740

Sample Data

Start Date/Time:		01/27/02 14:00
Stop Date/Time:		01/27/02 18:43
Effluent:	Estimated Percent Capture:	64%
	Avg. Successful Aliquots/Bottle:	37
	Max. Successful Aliquots (Bottle#3):	38
Influent:	Estimated Percent Capture:	99%
	Successful Aliquots/Bottle:	86

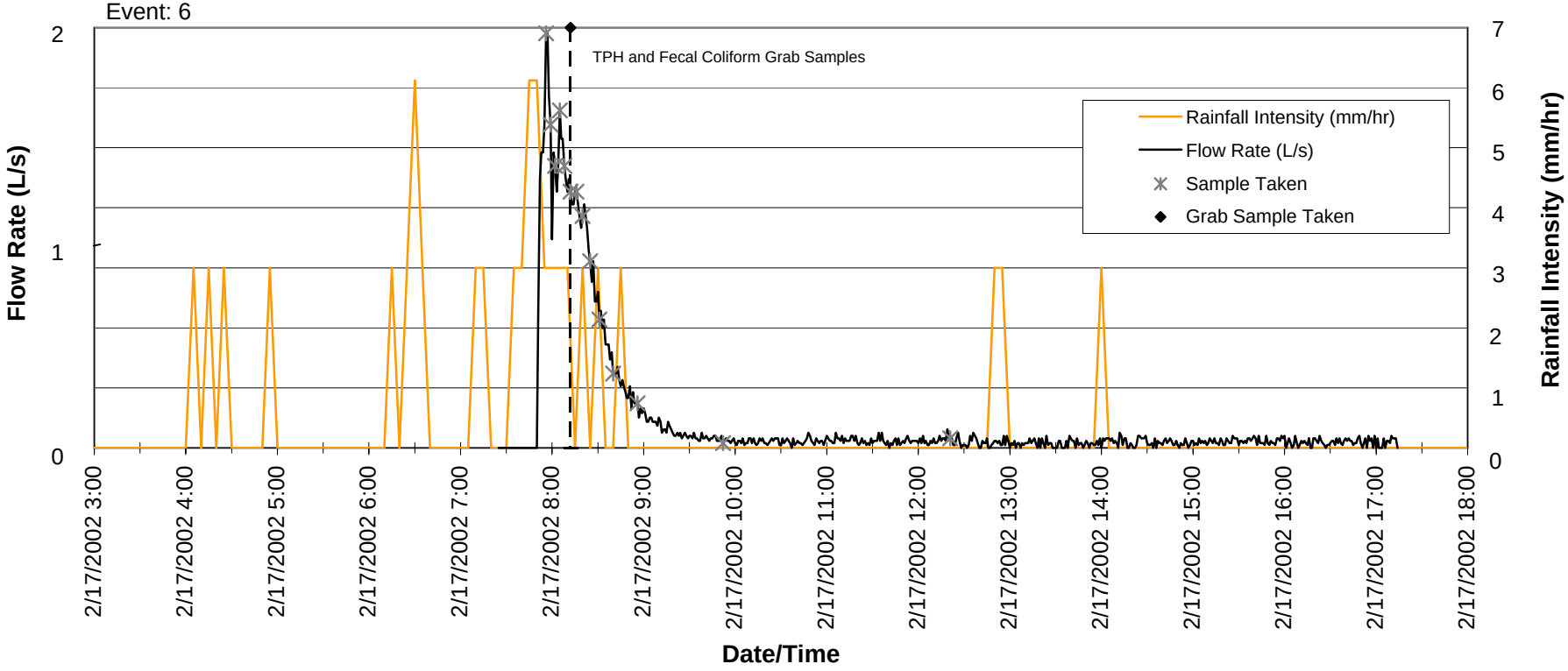
Notes:

The values for total event rain, total flow, and the number of aliquots collected during this storm event are known. The timeline of the hydrologic data was lost due to flowmeter malfunction. All data shown in this hydrograph with the exception of the known values reflects the data collected from the Filmore Street CDS unit adjusted to fit the known total event rain, total flow, and number of aliquots collected at the Orcas Avenue CDS unit.

Figure 1-9

Orcas Avenue CDS™ Unit
Event: 6

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	02/17/02 04:05
Stop Date/Time:	02/17/02 14:00
Event Rain (mm):	6.78
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	02/17/02 07:25
Stop Date/Time:	02/17/02 17:15
Total Flow Volume (L):	4538
Peak Flow (L/s):	1.97
Observed Runoff Coefficient:	0.149

Sample Data

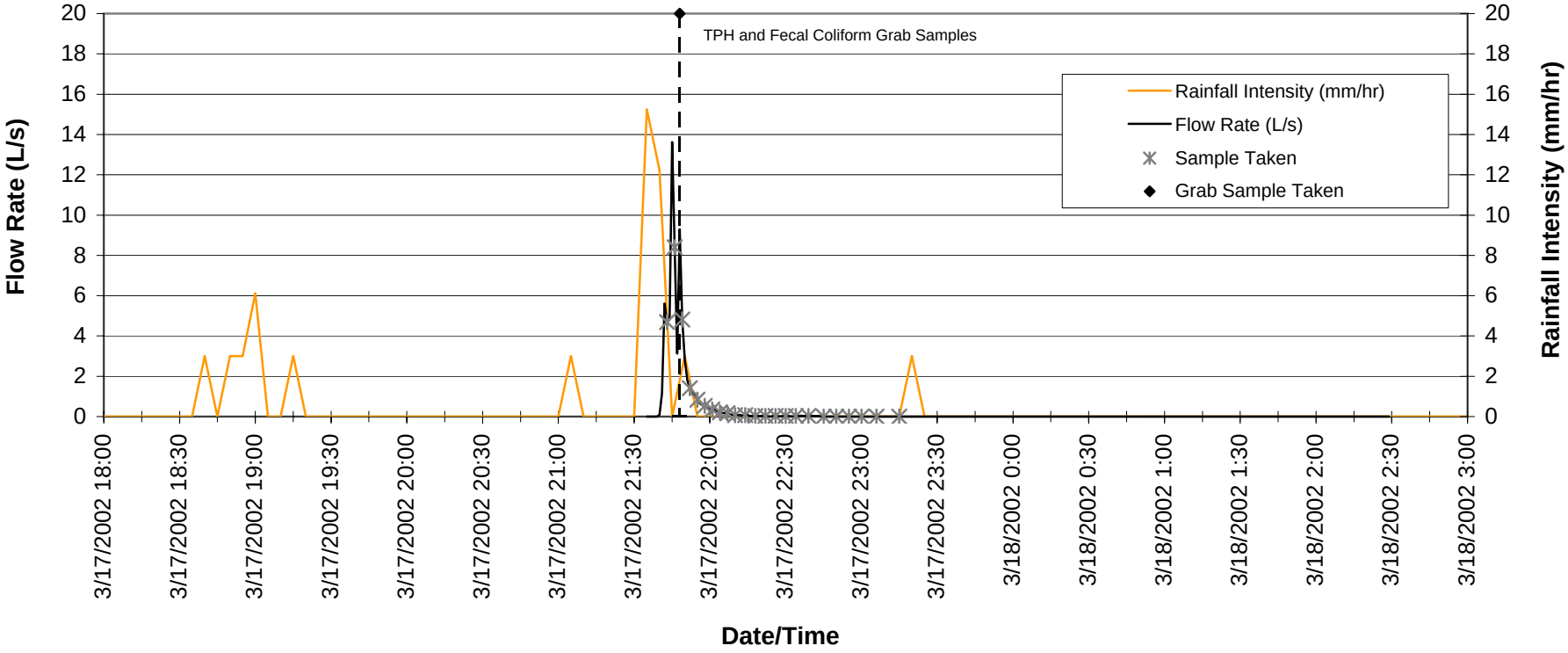
Start Date/Time:		02/17/02 07:25
Stop Date/Time:		02/17/02 12:26
Effluent:	Estimated Percent Capture:	90%
	Successful Aliquots:	14
Influent:	Estimated Percent Capture:	89%
	Successful Aliquots:	14

Notes: No flow or debris bypass.

Figure 1-10

Orcas Avenue CDS™ Unit
Event: 7

Catchment Area (ha): 0.45



Rain Data

Start Date/Time:	03/17/02 18:40
Stop Date/Time:	03/17/02 21:05
Event Rain (mm):	4.05
Max Intensity (mm/hr):	15.24

Runoff Data

Start Date/Time:	03/17/02 21:35
Stop Date/Time:	03/18/02 02:30
Total Flow Volume (L):	4222
Peak Flow (L/s):	13.62
Observed Runoff Coefficient:	0.232

Sample Data

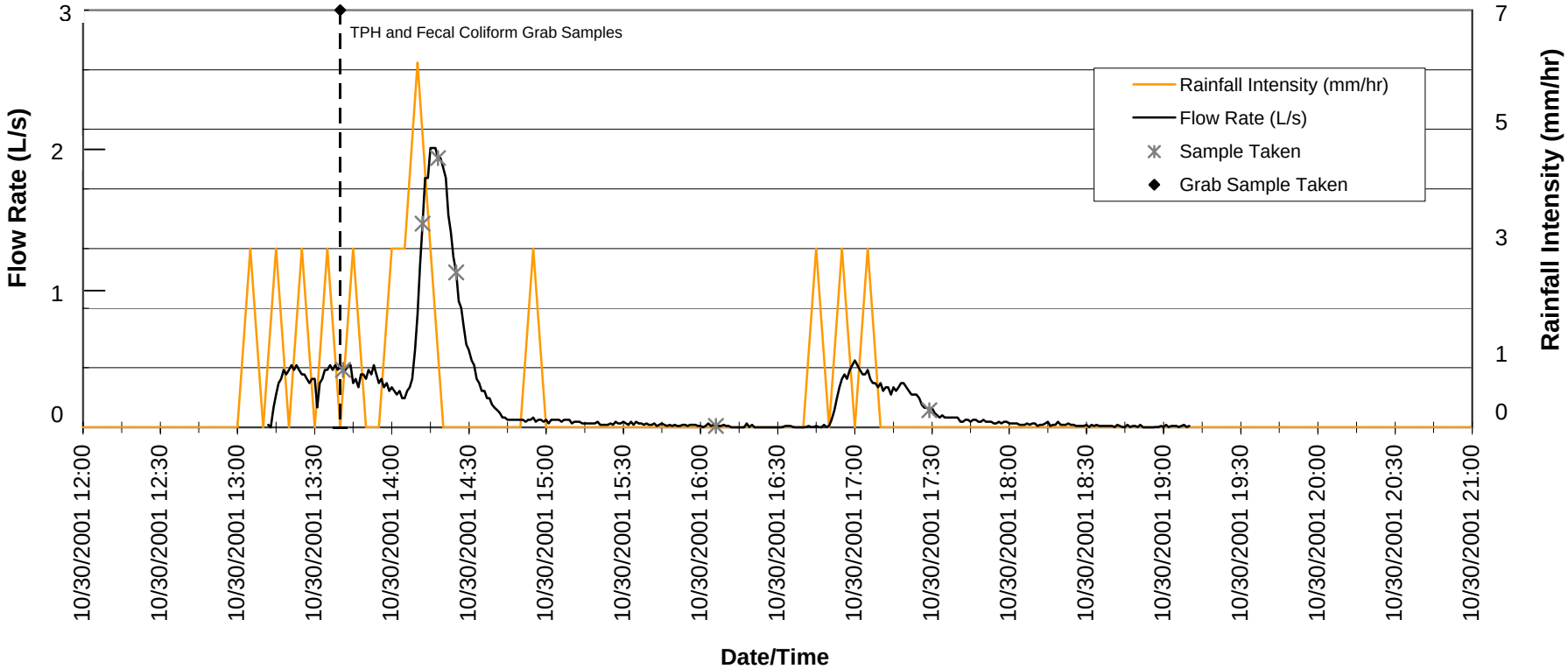
Start		03/17/02 21:35
Stop Date/Time:		03/17/02 23:31
Effluent:	Estimated Percent Capture:	99%
	Successful Aliquots:	23
Influent:	Estimated Percent Capture:	100%
	Successful Aliquots:	52

Notes: No flow or debris bypass.

Figure 1-11

Filmore Street CDS™ Unit
Event: 1

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	10/30/01 13:05
Stop Date/Time:	10/30/01 17:05
Event Rain (mm):	3.51
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	10/30/01 13:12
Stop Date/Time:	10/30/01 19:11
Total Flow Volume (L):	4159
Peak Flow (L/s):	2.01
Observed Runoff Coefficient:	0.117

Sample Data

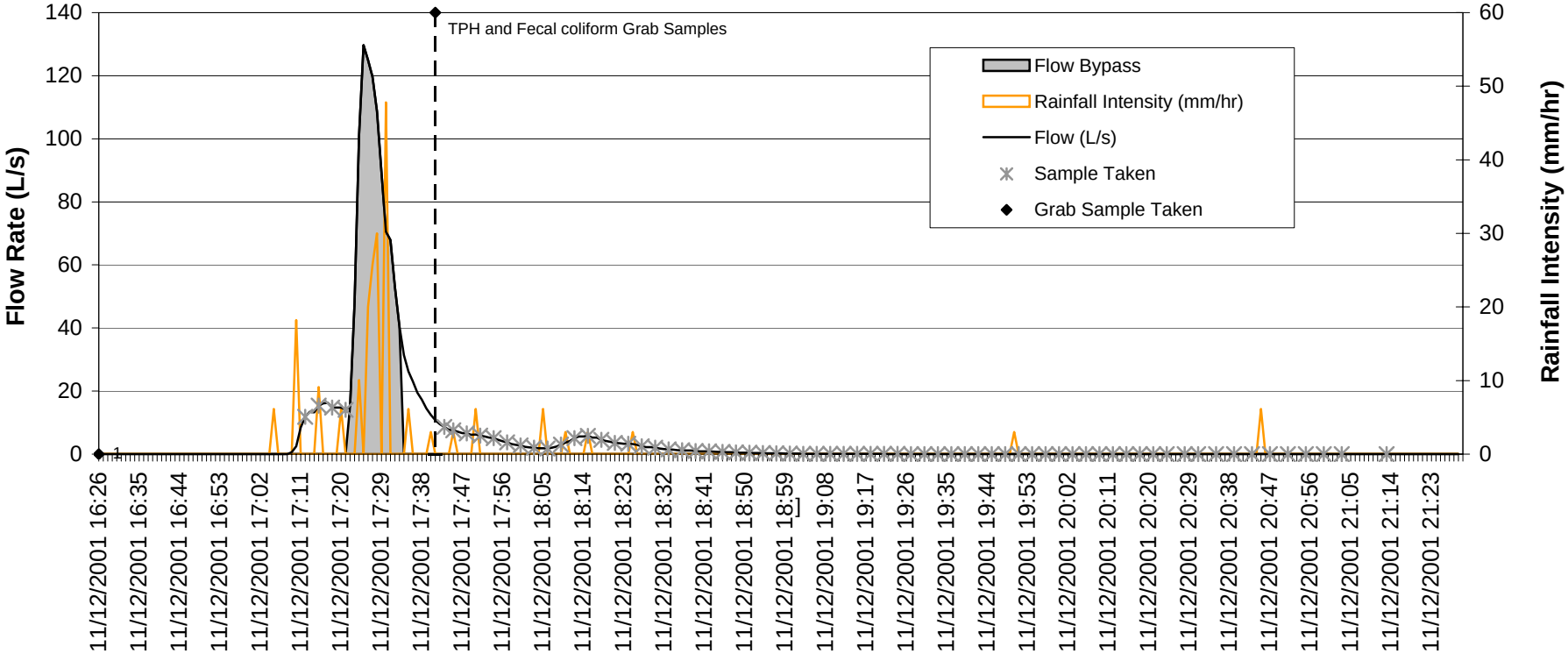
Start Date/Time:		10/30/01 13:12
Stop Date/Time:		10/30/01 17:30
Effluent:	Estimated Percent Capture:	96%
	Successful Aliquots:	6
Influent:	Estimated Percent Capture:	96%
	Successful Aliquots:	6

Notes: First storm event of season. Sample aliquots well distributed and flow-weighted across the hydrograph. Accordingly, composite sample considered representative. No flow or debris bypass.

Figure 1-12

Filmore Street CDS™ Unit
Event: 2

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	11/12/01 17:05
Stop Date/Time:	11/12/01 20:45
Event Rain (mm):	12.62
Max Intensity (mm/hr):	47.80

Runoff Data

Start Date/Time:	11/12/01 17:08
Stop Date/Time:	11/12/01 21:20
Total Flow Volume (L):	90926
Peak Flow (L/s):	125.00
Observed Runoff Coefficient:	0.713

Sample Data

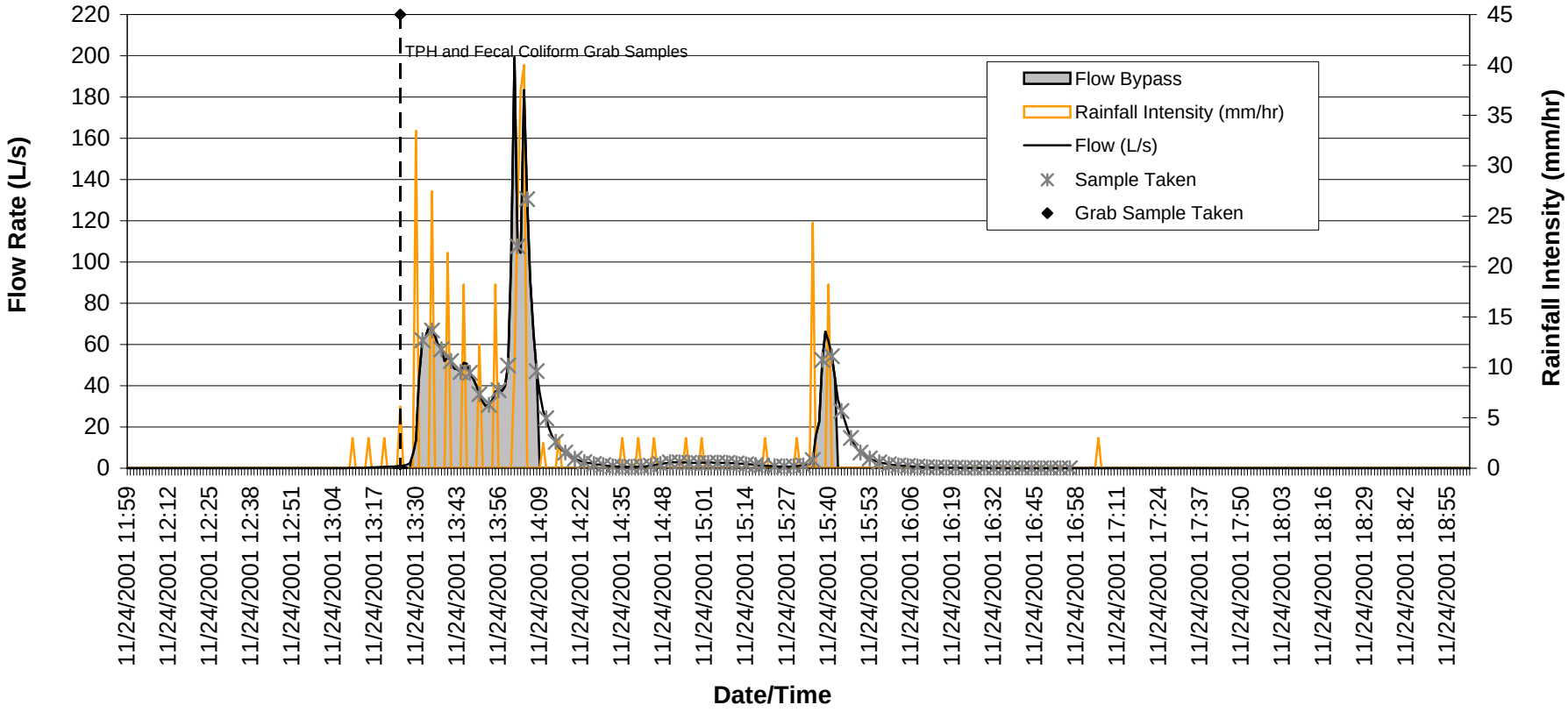
Start Date/Time:		11/12/01 17:08
Stop Date/Time:		11/12/01 21:13
Effluent:	Estimated Percent Capture:	97%
	Avg. Successful Aliquots/Bottle:	70
	Max. Successful Aliquots (Bottle#2):	71
Influent:	Estimated Percent Capture:	100%
	Avg. Successful Aliquots/Bottle:	70
	Max. Successful Aliquots (Bottle#1):	71

Notes: Flow and debris bypass occurred.

Figure 1-13

Filmore Street CDS™ Unit
Event: 3

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	11/24/01 13:00
Stop Date/Time:	11/24/01 15:40
Event Rain (mm):	24.49
Max Intensity (mm/hr):	40.00

Runoff Data

Start Date/Time:	11/24/01 13:07
Stop Date/Time:	11/24/01 19:03
Total Flow Volume (L):	196892
Peak Flow (L/s):	199.36
Observed Runoff Coefficient:	0.796

Sample Data

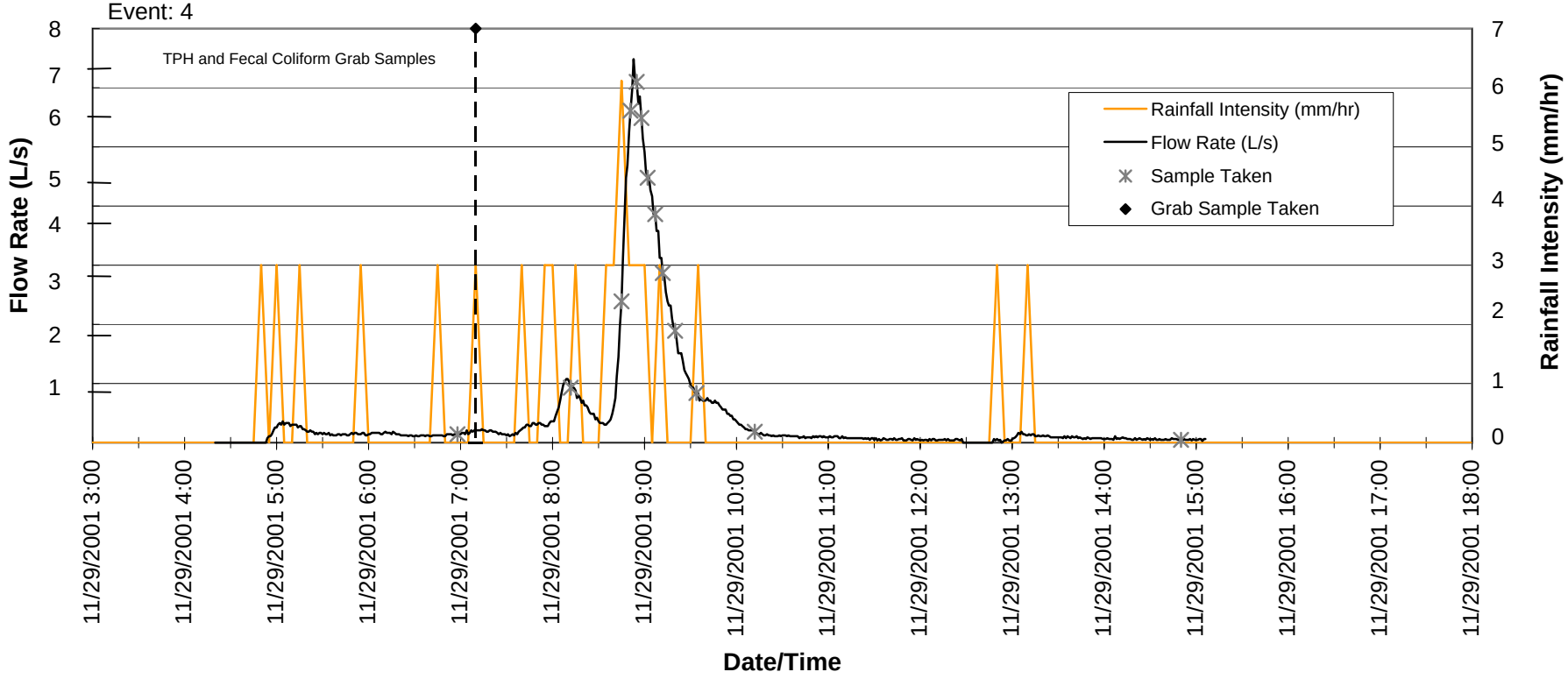
Start Date/Time:		11/24/01 13:07
Stop Date/Time:		11/24/01 16:57
Effluent:	Estimated Percent Capture:	100%
	Successful Aliquots:	69
Influent:	Estimated Percent Capture:	100%
	Successful Aliquots:	69

Notes: Flow and debris bypass occurred.

Figure 1-14

Filmore Street CDS™ Unit
Event: 4

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	11/29/01 04:50
Stop Date/Time:	11/29/01 13:10
Event Rain (mm):	5.26
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	11/29/01 04:20
Stop Date/Time:	11/29/01 15:07
Total Flow Volume (L):	18267
Peak Flow (L/s):	7.41
Observed Runoff Coefficient:	0.344

Sample Data

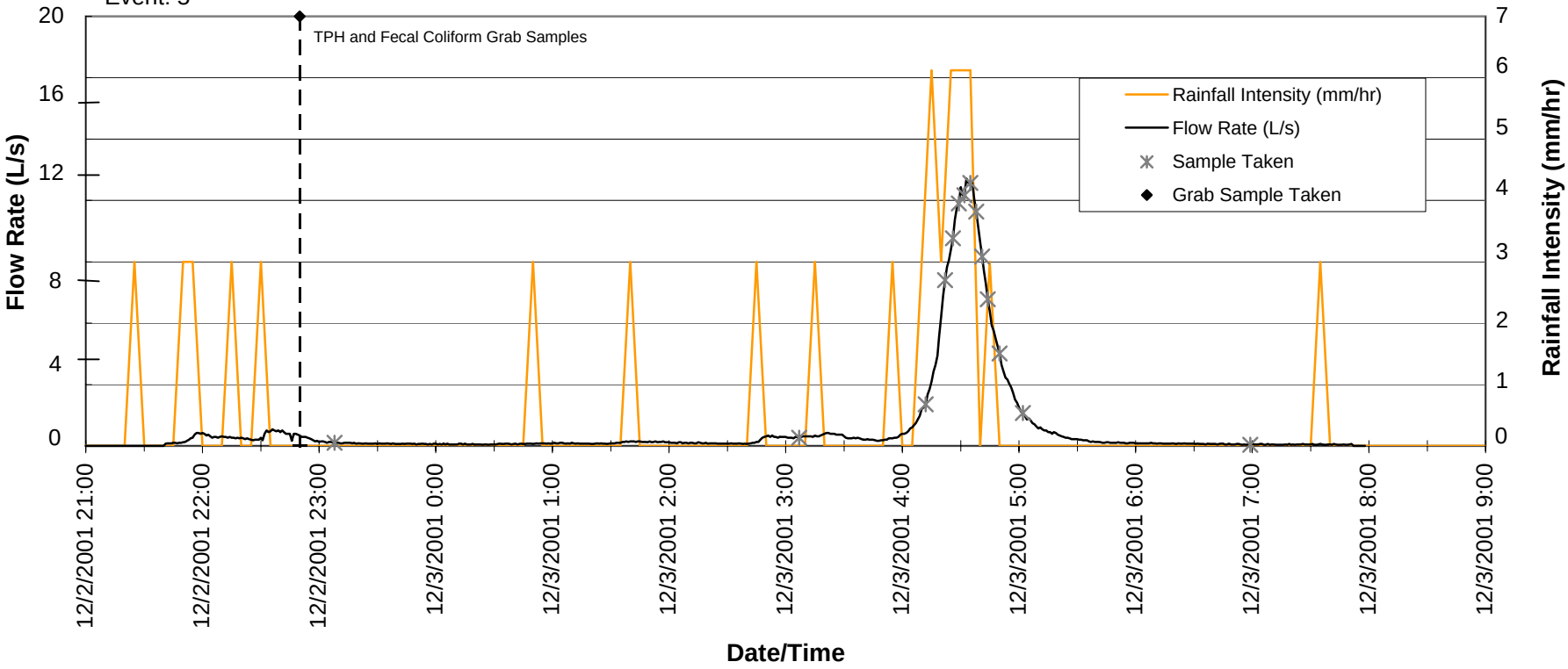
Start Date/Time:		11/29/01 04:20
Stop Date/Time:		11/29/01 14:51
Effluent:	Estimated Percent Capture:	100%
	Successful Aliquots:	13
Influent:	Estimated Percent Capture:	100%
	Successful Aliquots:	13

Notes: No flow or debris bypass.

Figure 1-15

Filmore Street CDS™ Unit
Event: 5

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	12/02/01 21:25
Stop Date/Time:	12/03/01 07:35
Event Rain (mm):	5.54
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	12/02/01 21:00
Stop Date/Time:	12/03/01 07:59
Total Flow Volume (L):	28216
Peak Flow (L/s):	12.45
Observed Runoff Coefficient:	0.504

Sample Data

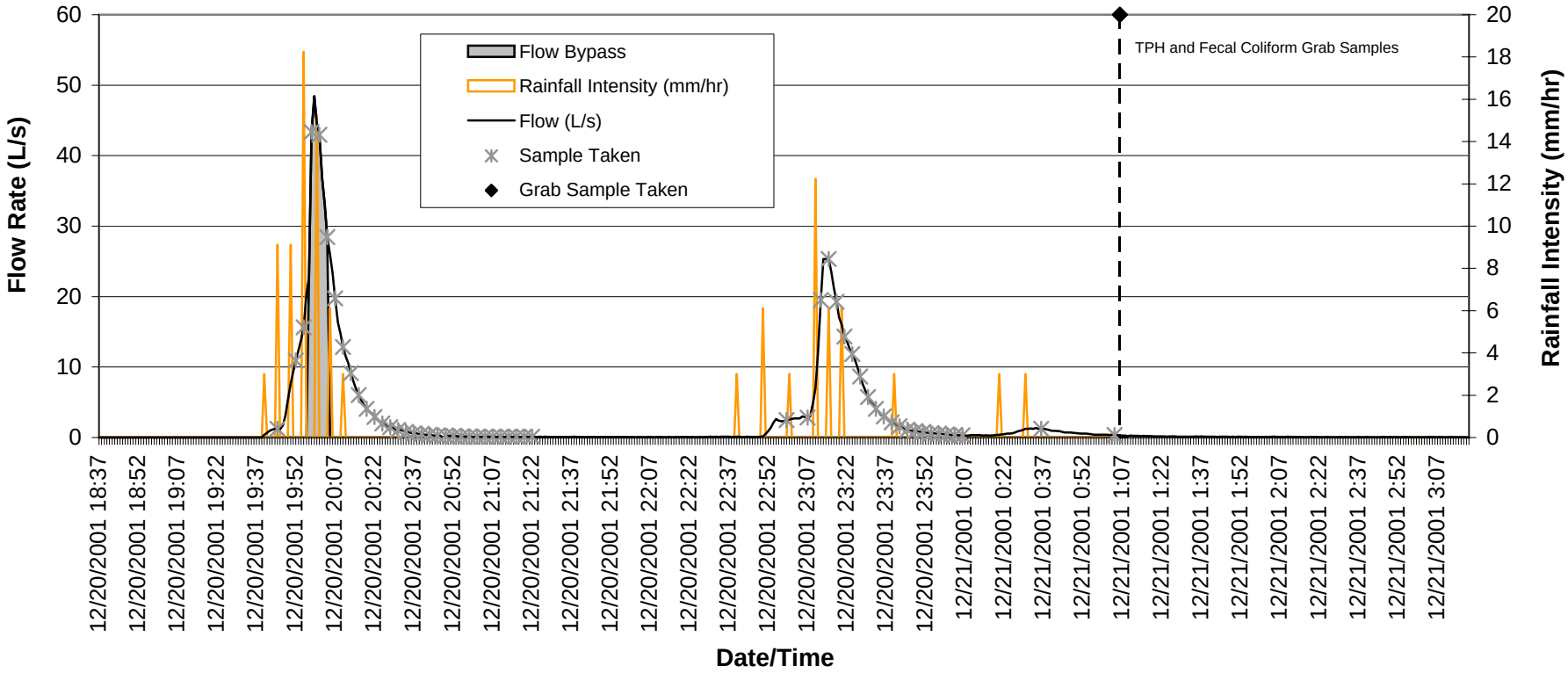
Start Date/Time:		12/02/01 21:00
Stop Date/Time:		12/03/01 07:00
Effluent:	Estimated Percent Capture:	99%
	Successful Aliquots:	14
Influent:	Estimated Percent Capture:	99%
	Successful Aliquots:	14

Notes: No flow or debris bypass.

Figure 1-16

Filmore Street CDS™ Unit
Event: 6

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	12/20/01 19:35
Stop Date/Time:	12/21/01 00:30
Event Rain (mm):	9.62
Max Intensity (mm/hr):	18.24

Runoff Data

Start Date/Time:	12/20/01 19:36
Stop Date/Time:	12/21/01 03:20
Total Flow Volume (L):	65797
Peak Flow (L/s):	48.44
Observed Runoff Coefficient:	0.677

Sample Data

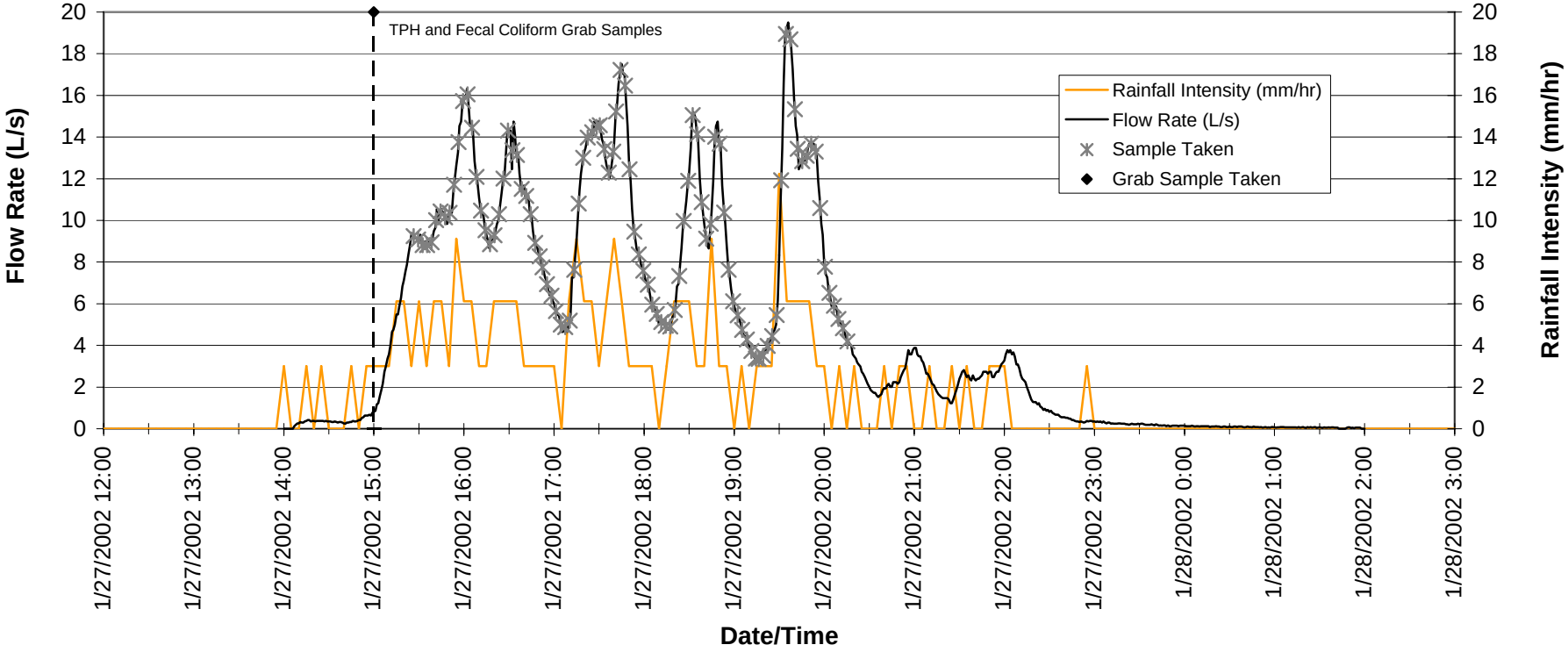
Start Date/Time:		12/20/01 19:36
Stop Date/Time:		12/21/01 01:06
Effluent:	Estimated Percent Capture:	99%
	Successful Aliquots:	55
Influent:	Estimated Percent Capture:	99%
	Successful Aliquots:	55

Notes: Flow bypass but no debris bypass.

Figure 1-17

Filmore Street CDS™ Unit
Event: 7

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	01/27/02 14:00
Stop Date/Time:	01/27/02 22:55
Event Rain (mm):	27.29
Max Intensity (mm/hr):	12.24

Runoff Data

Start Date/Time:	01/27/02 14:00
Stop Date/Time:	01/28/02 02:00
Total Flow Volume (L):	201739
Peak Flow (L/s):	19.51
Observed Runoff Coefficient:	0.731

Sample Data

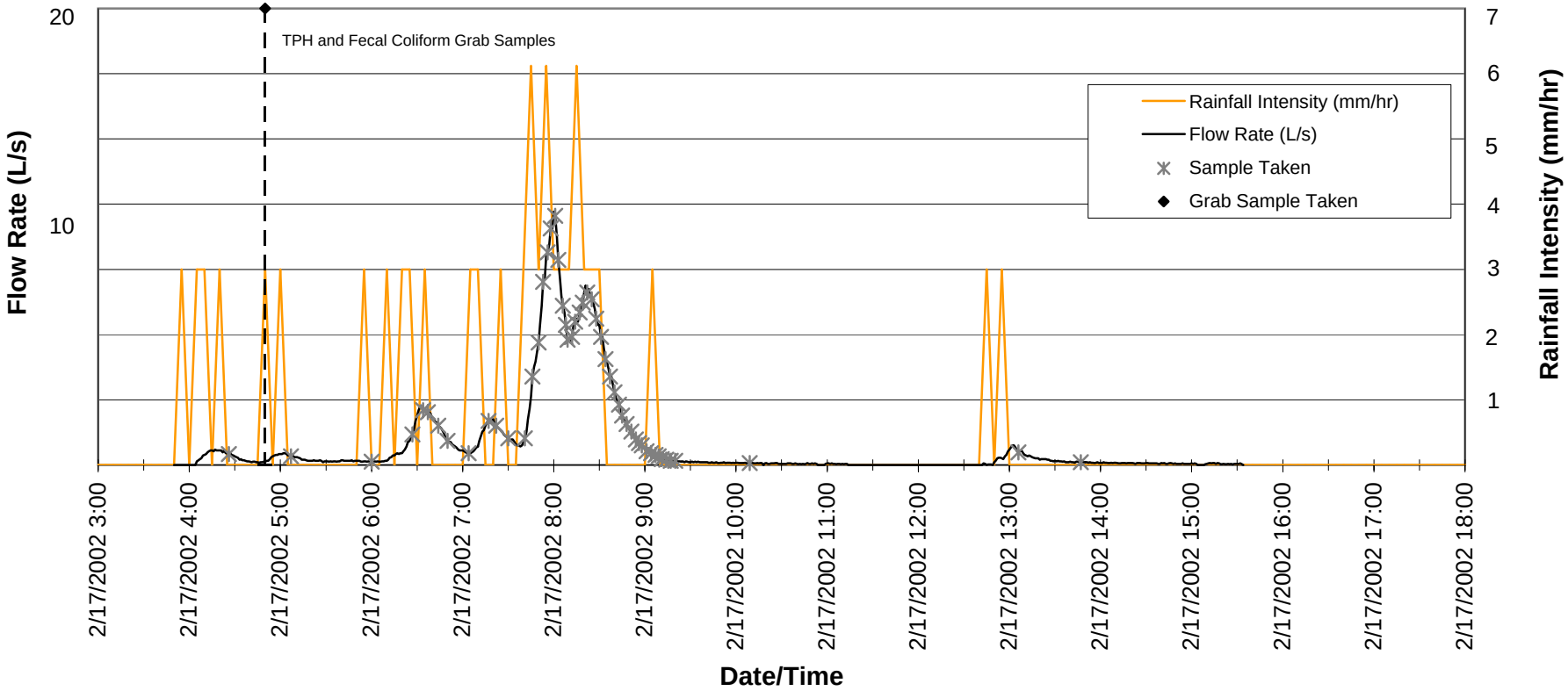
Start Date/Time:		01/27/02 14:00
Stop Date/Time:		01/27/02 20:17
Effluent:	Estimated Percent Capture:	89%
	Successful Aliquots:	100
Influent:	Estimated Percent Capture:	91%
	Successful Aliquots:	100

Notes: No flow or debris bypass.

Figure 1-18

Filmore Street CDS™ Unit
Event: 8

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	02/17/02 03:55
Stop Date/Time:	02/17/02 12:55
Event Rain (mm):	7.78
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	02/17/02 04:05
Stop Date/Time:	02/17/02 15:35
Total Flow Volume (L):	35977
Peak Flow (L/s):	11.10
Observed Runoff Coefficient:	0.458

Sample Data

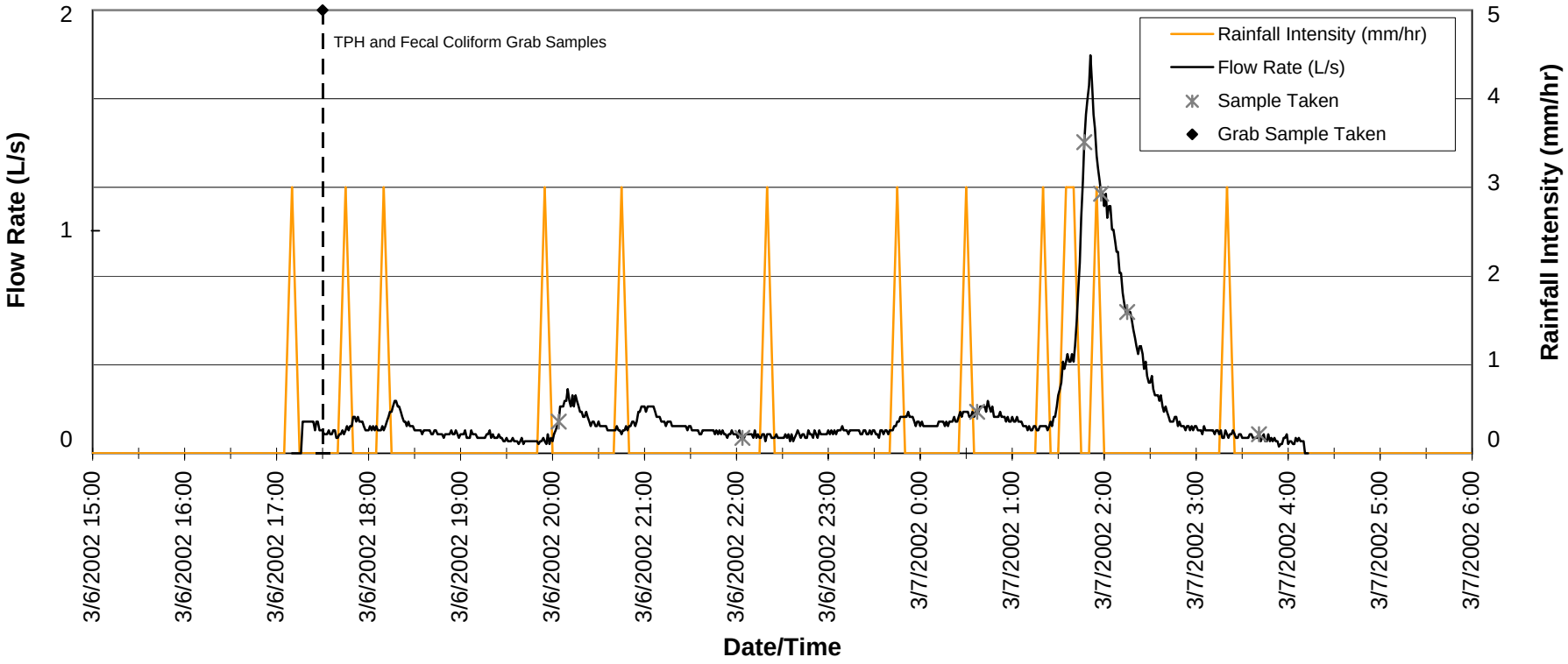
Start Date/Time:		02/17/02 04:05
Stop Date/Time:		02/17/02 13:48
Effluent:	Estimated Percent Capture:	97%
	Avg. Successful Aliquots/Bottle:	51
	Max. Successful Aliquots (Bottle#2):	52
Influent:	Estimated Percent Capture:	99%
	Avg. Successful Aliquots/Bottle:	52

Notes: No flow or debris bypass.

Figure 1-19

Filmore Street CDS™ Unit
Event: 9

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	03/06/02 17:10
Stop Date/Time:	03/07/02 3:20
Event Rain (mm):	3.25
Max Intensity (mm/hr):	3.00

Runoff Data

Start Date/Time:	03/06/02 17:10
Stop Date/Time:	03/07/02 04:14
Total Flow Volume (L):	7106
Peak Flow (L/s):	1.80
Observed Runoff Coefficient:	0.216

Sample Data

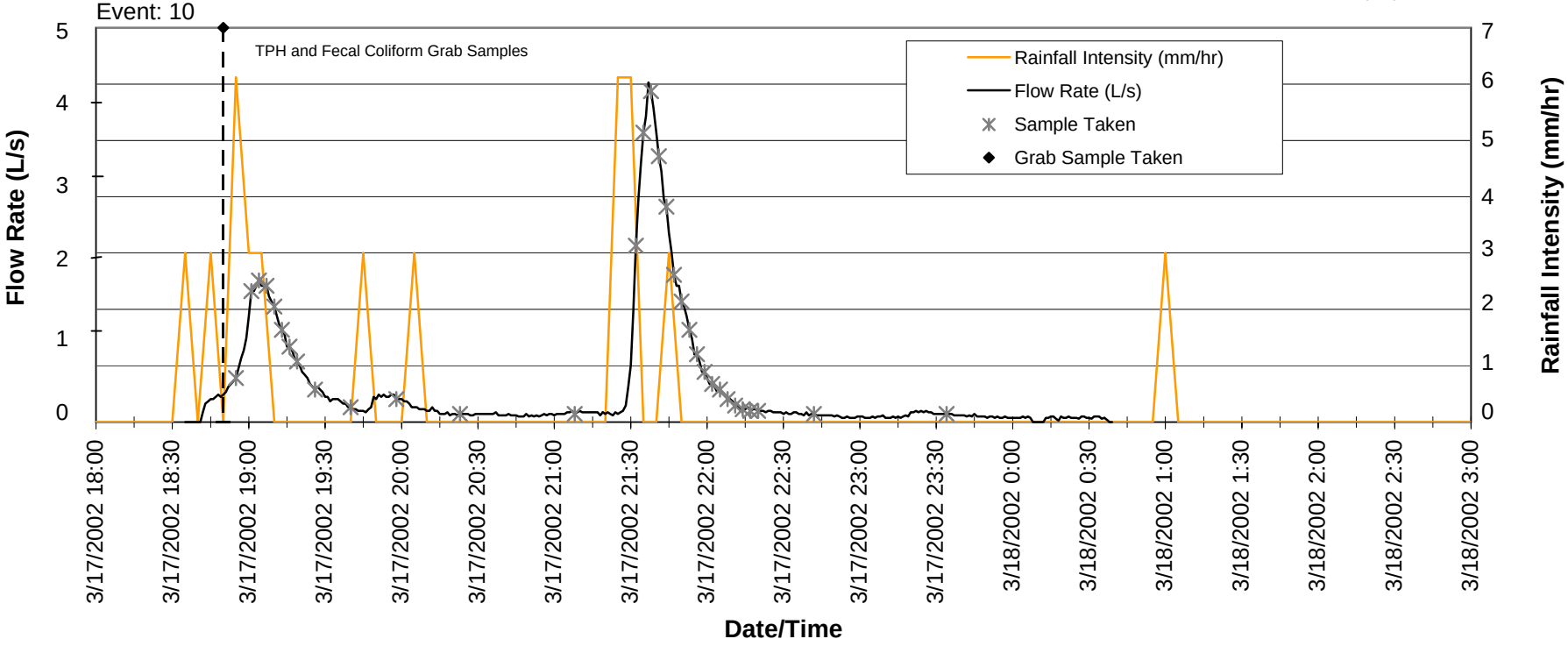
Start Date/Time:		03/06/02 17:10
Stop Date/Time:		03/07/02 03:42
Effluent:	Estimated Percent Capture:	99%
	Successful Aliquots:	7
Influent:	Estimated Percent Capture:	99%
	Successful Aliquots:	7

Notes: No flow or debris bypass.

Figure 1-20

Filmore Street CDS™ Unit
Event: 10

Catchment Area (ha): 1.01



Rain Data

Start Date/Time:	03/17/02 18:35
Stop Date/Time:	03/17/02 21:45
Event Rain (mm):	3.28
Max Intensity (mm/hr):	6.12

Runoff Data

Start Date/Time:	03/17/02 18:35
Stop Date/Time:	03/18/02 00:40
Total Flow Volume (L):	8552
Peak Flow (L/s):	4.31
Observed Runoff Coefficient:	0.258

Sample Data

Start Date/Time:		03/17/02 18:35
Stop Date/Time:		03/17/02 23:35
Effluent:	Estimated Percent Capture:	97%
	Successful Aliquots:	32
Influent:	Estimated Percent Capture:	96%
	Successful Aliquots:	32

Notes: No flow or debris bypass.

Figure 1-21

Gross Pollutant Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001

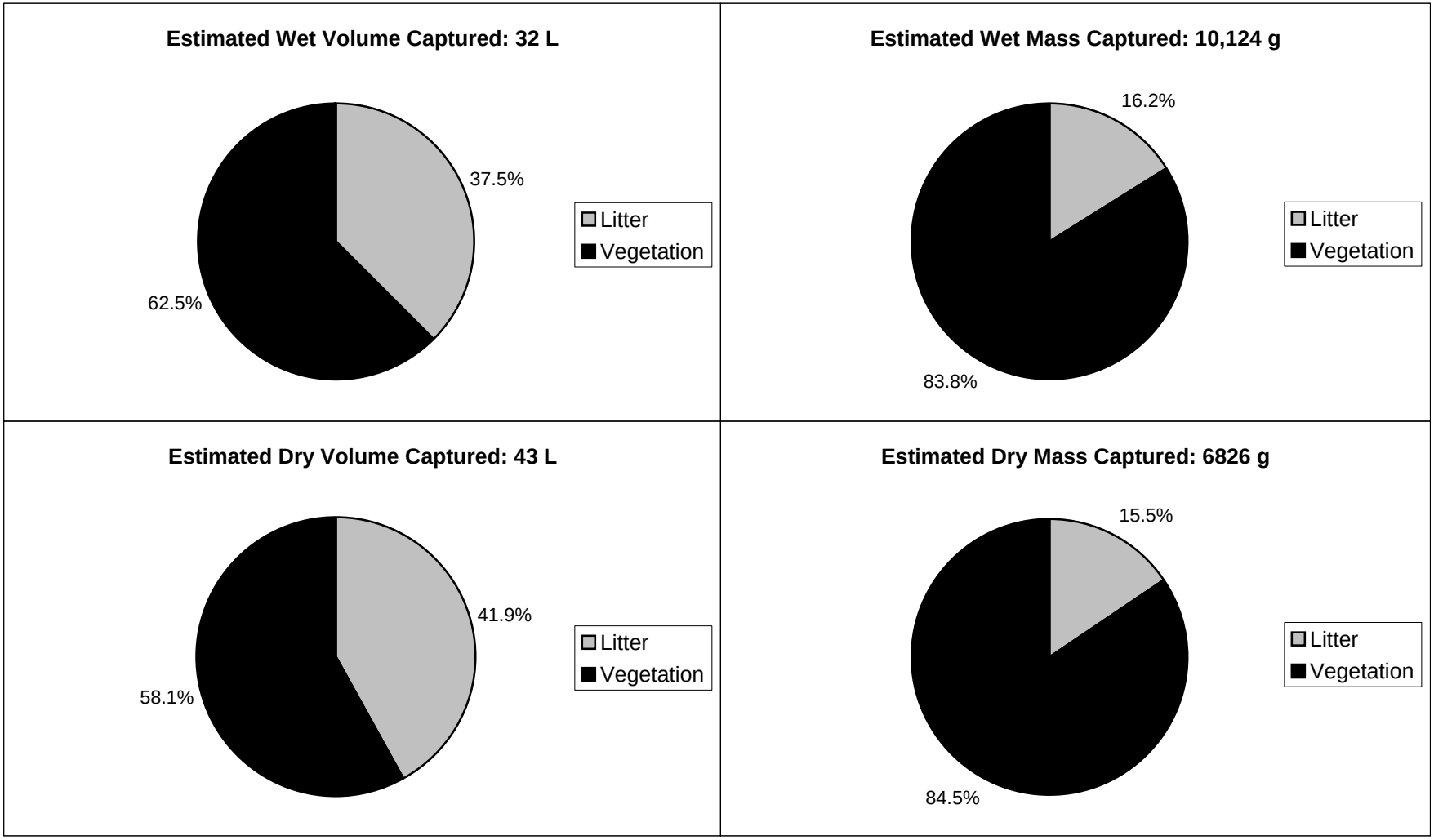
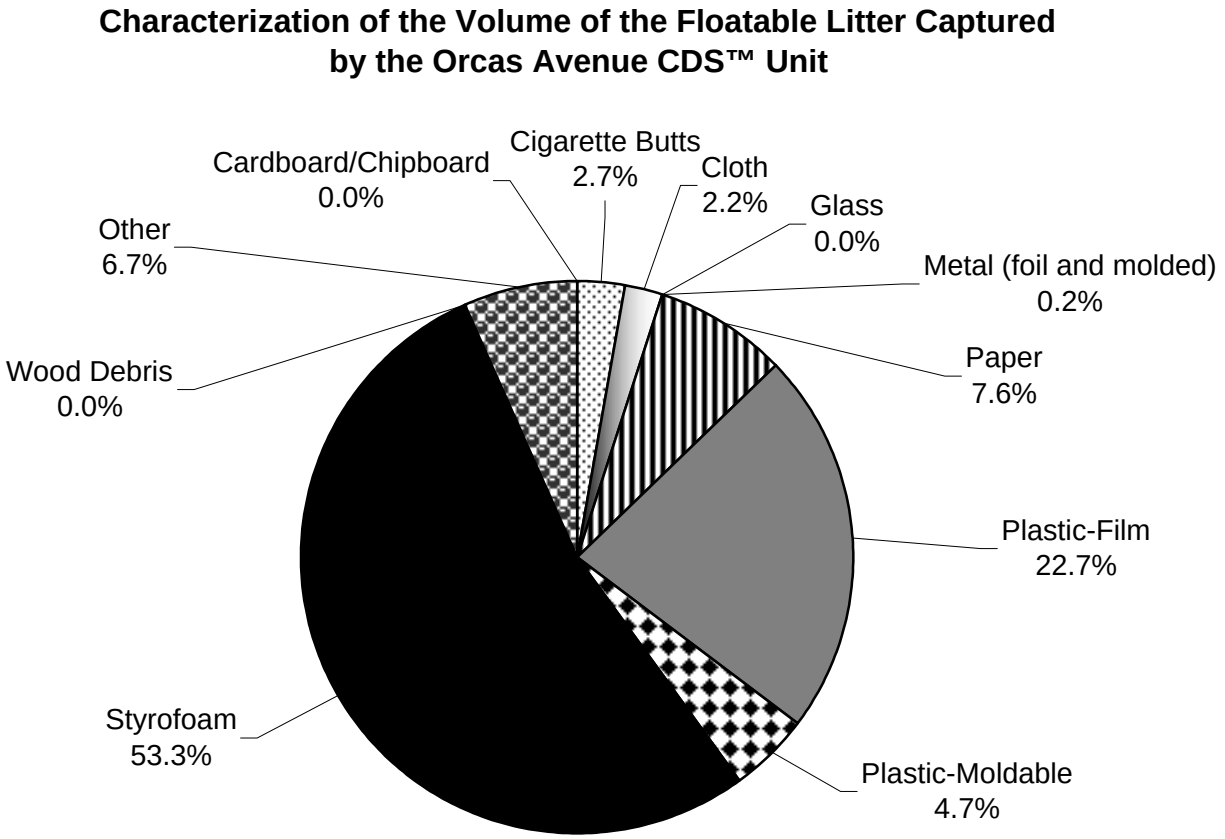


Figure 1-22

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001

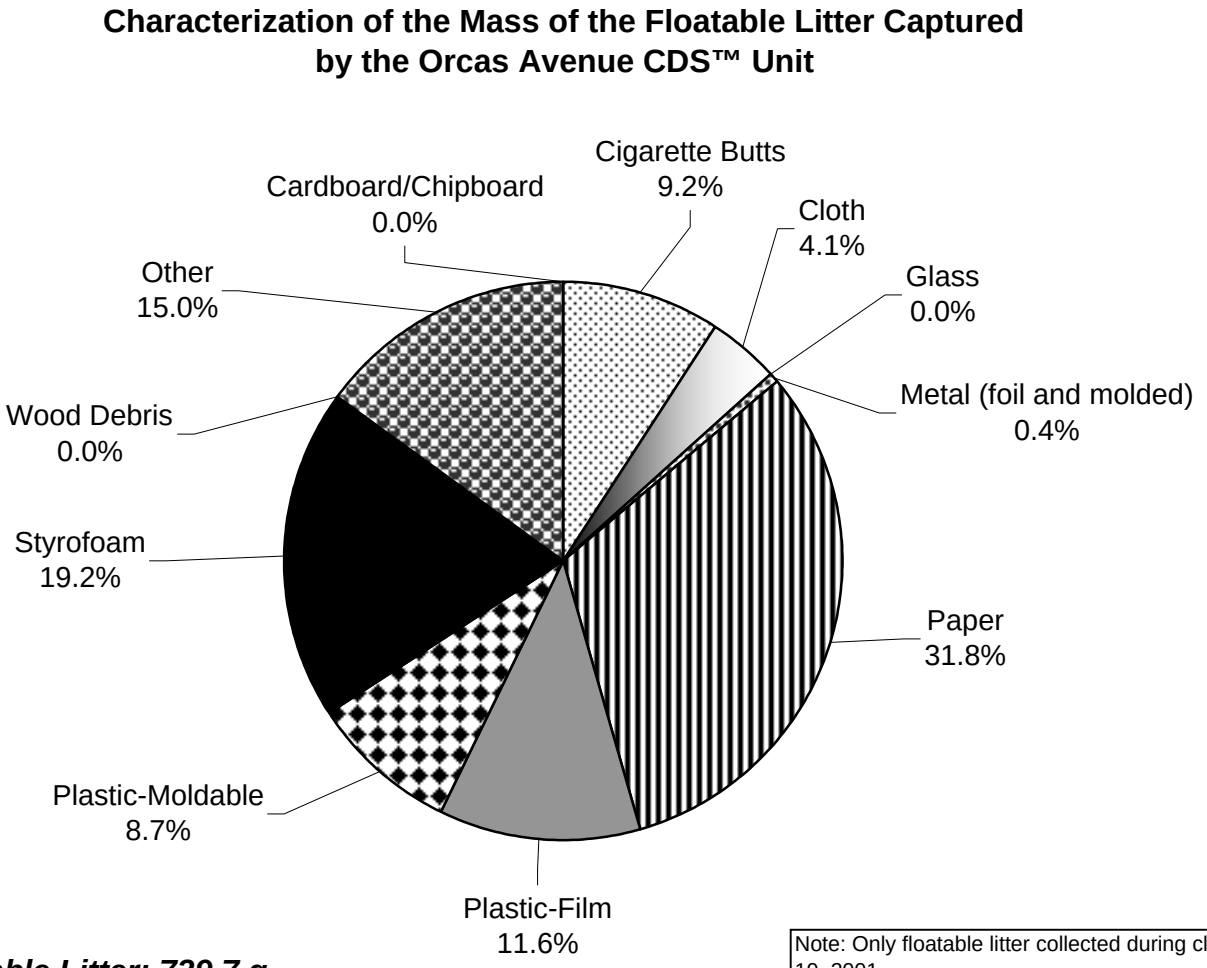


Total Volume of Floatable Litter: 11,250 ml

Note: Only floatable litter collected during cleanout on November 19, 2001.

Figure 1-23

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001

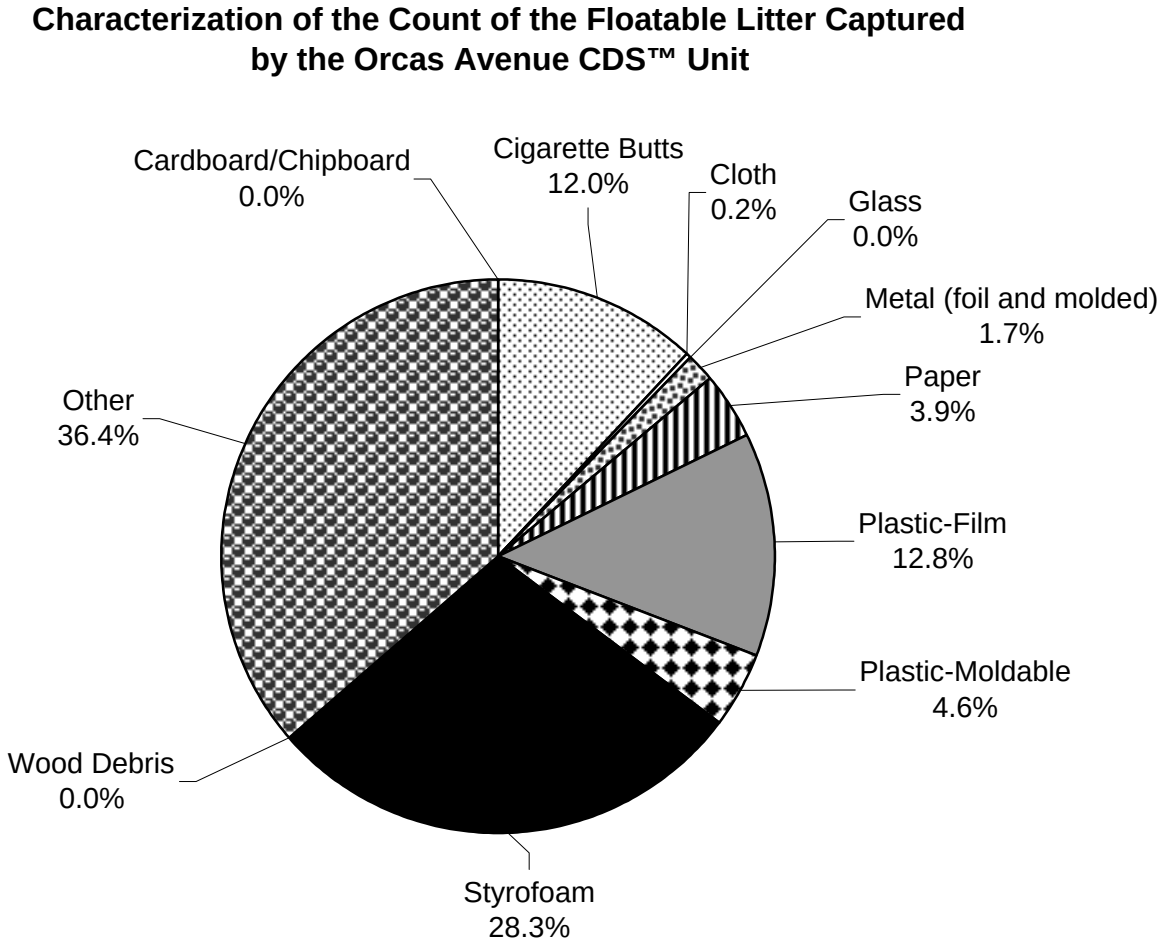


Total Mass of Floatable Litter: 729.7 g

Note: Only floatable litter collected during cleanout on November 19, 2001.

Figure 1-24

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001



Total Count of Floatable Litter: 888 pieces

Note: Only floatable litter collected during cleanout on November 19, 2001.

Figure 1-25

Gross Pollutant Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

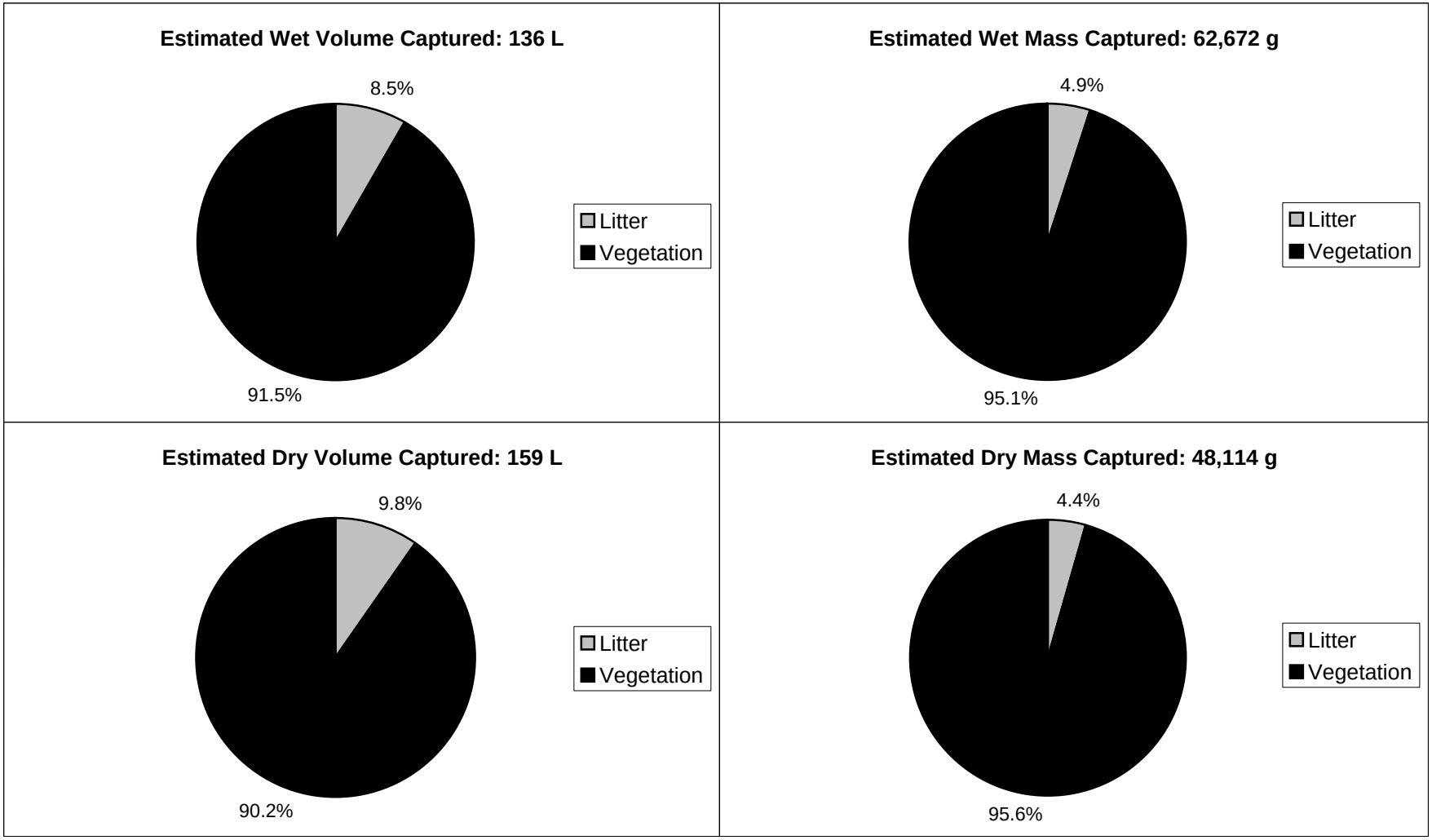
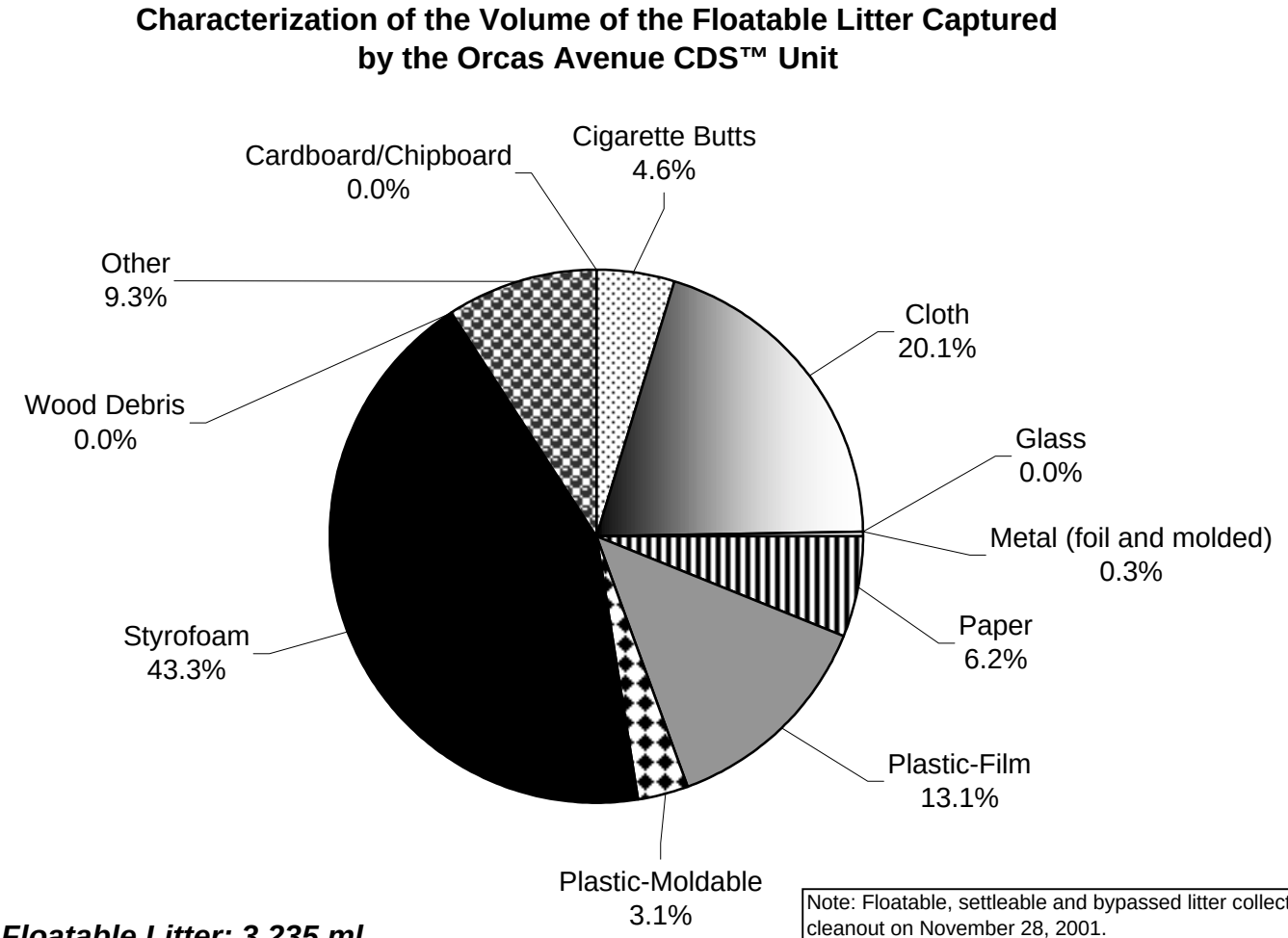


Figure 1-26

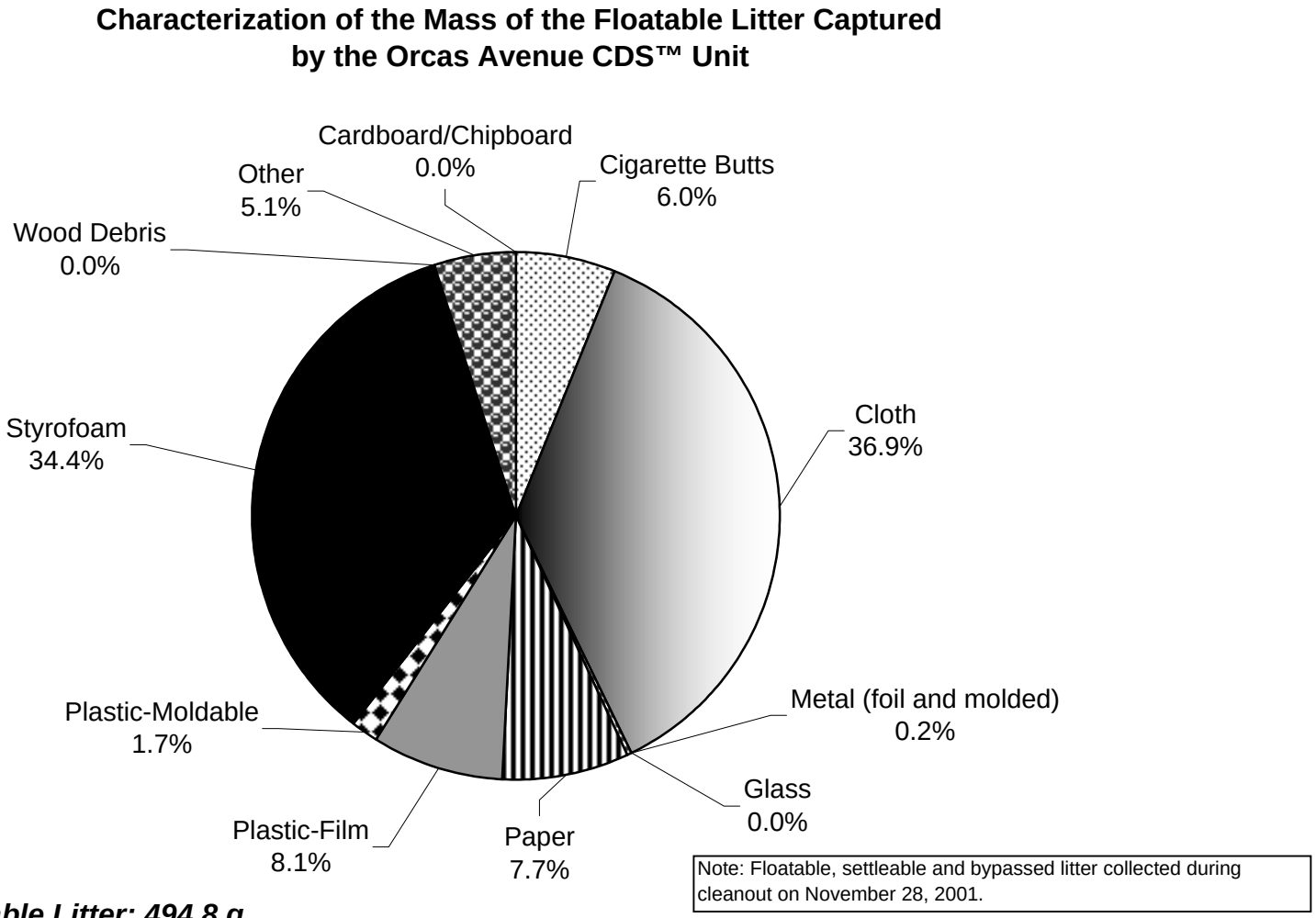
Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001



Total Volume of Floatable Litter: 3,235 ml

Figure 1-27

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

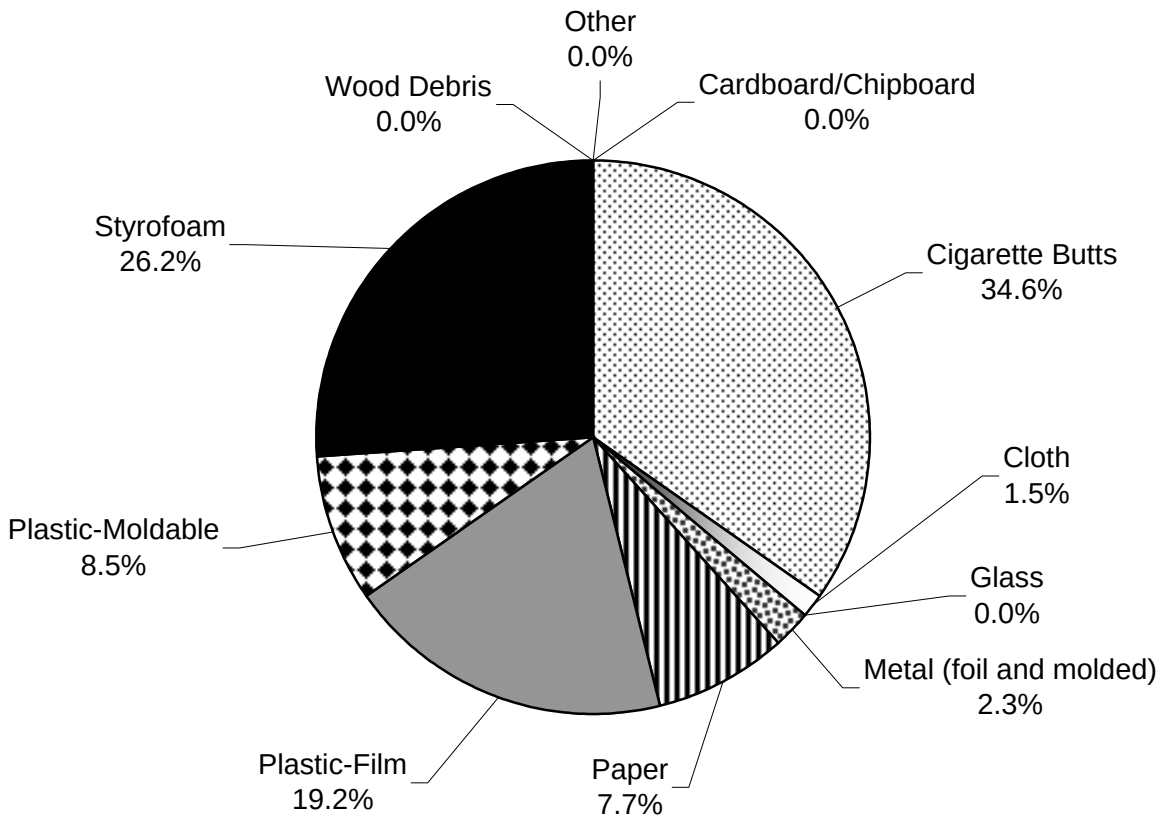


Total Mass of Floatable Litter: 494.8 g

Figure 1-28

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

Characterization of the Count of the Floatable Litter Captured by the Orcas Avenue CDS™ Unit

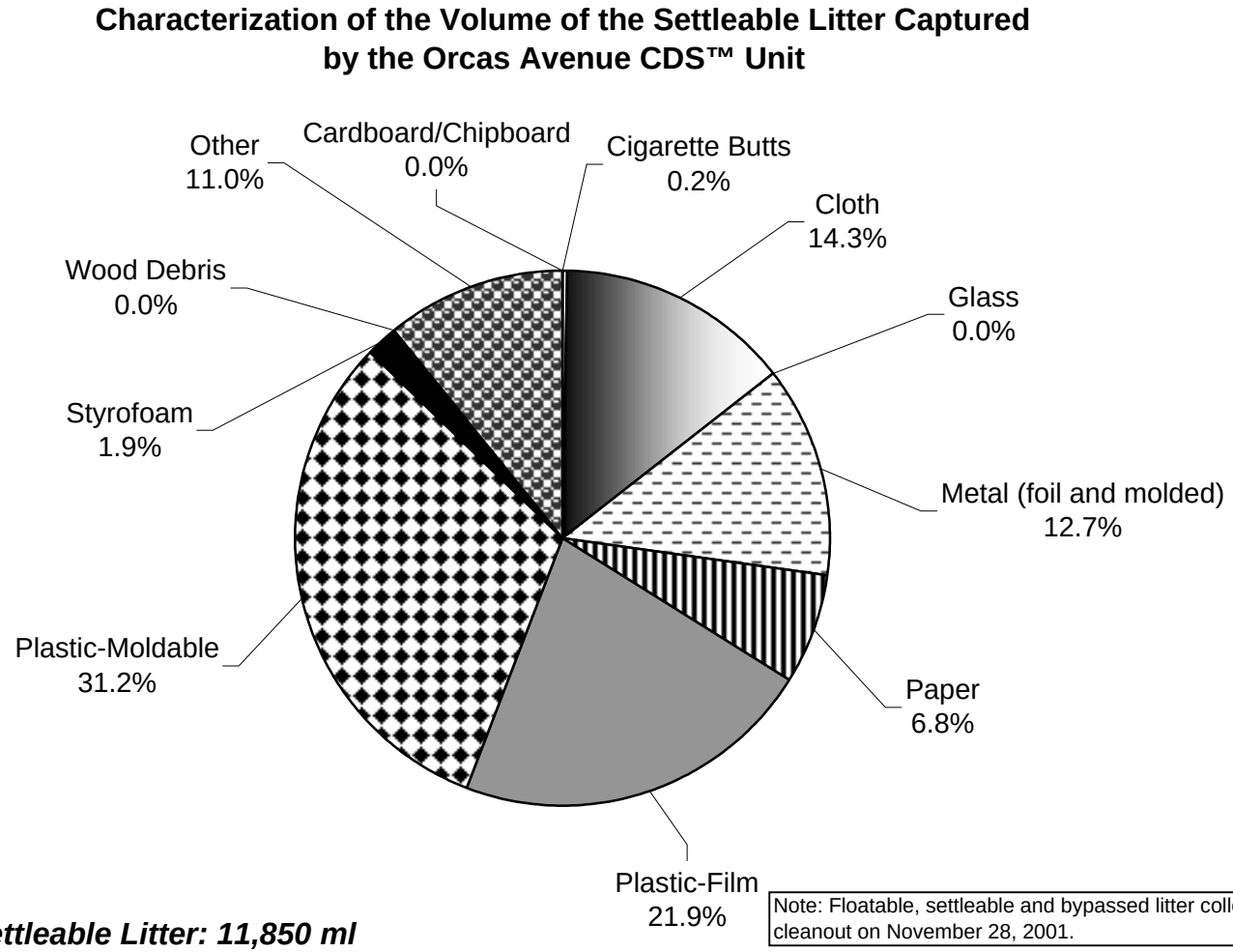


Total Count of Floatable Litter: 130 pieces

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-29

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

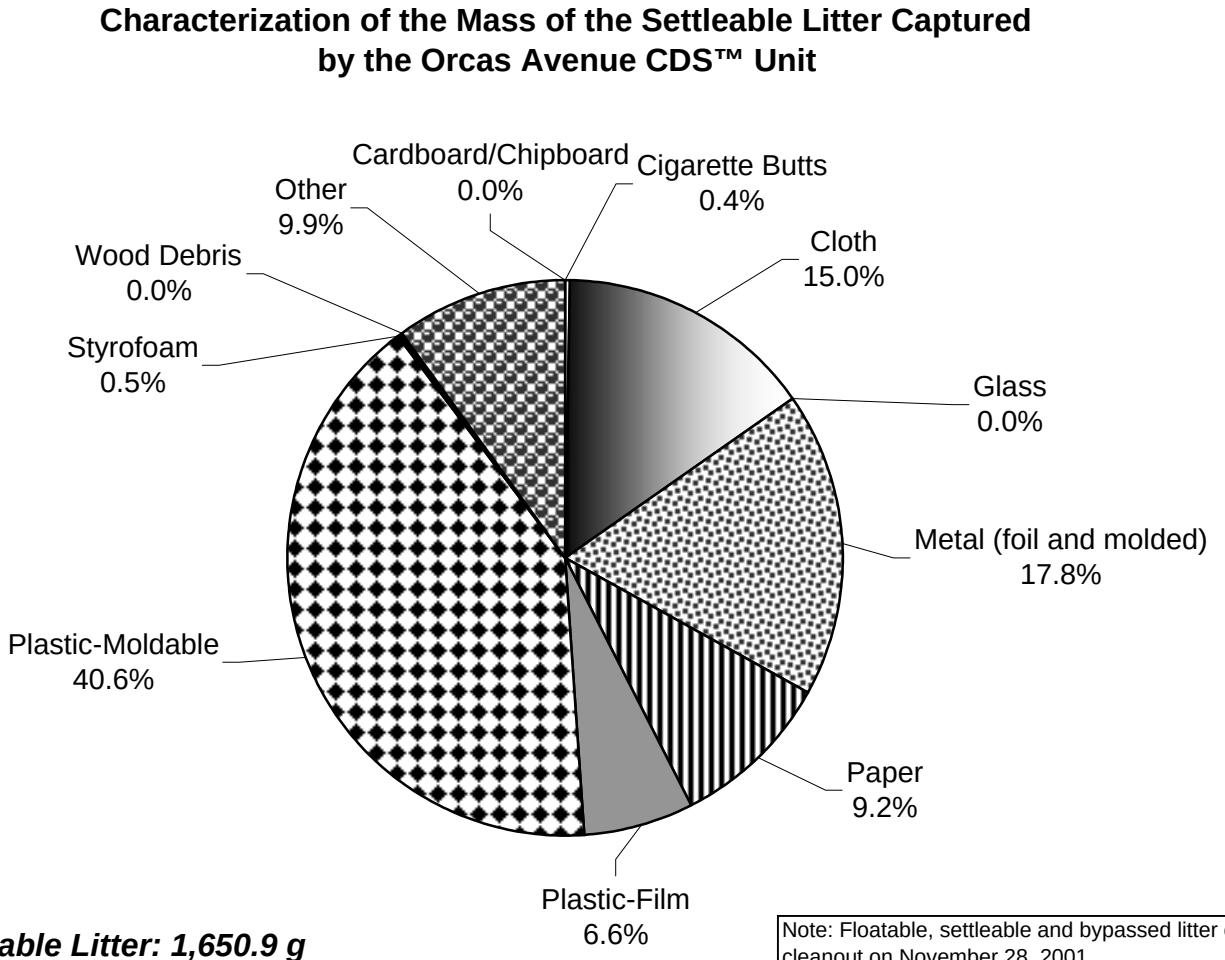


Total Volume of Settleable Litter: 11,850 ml

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-30

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

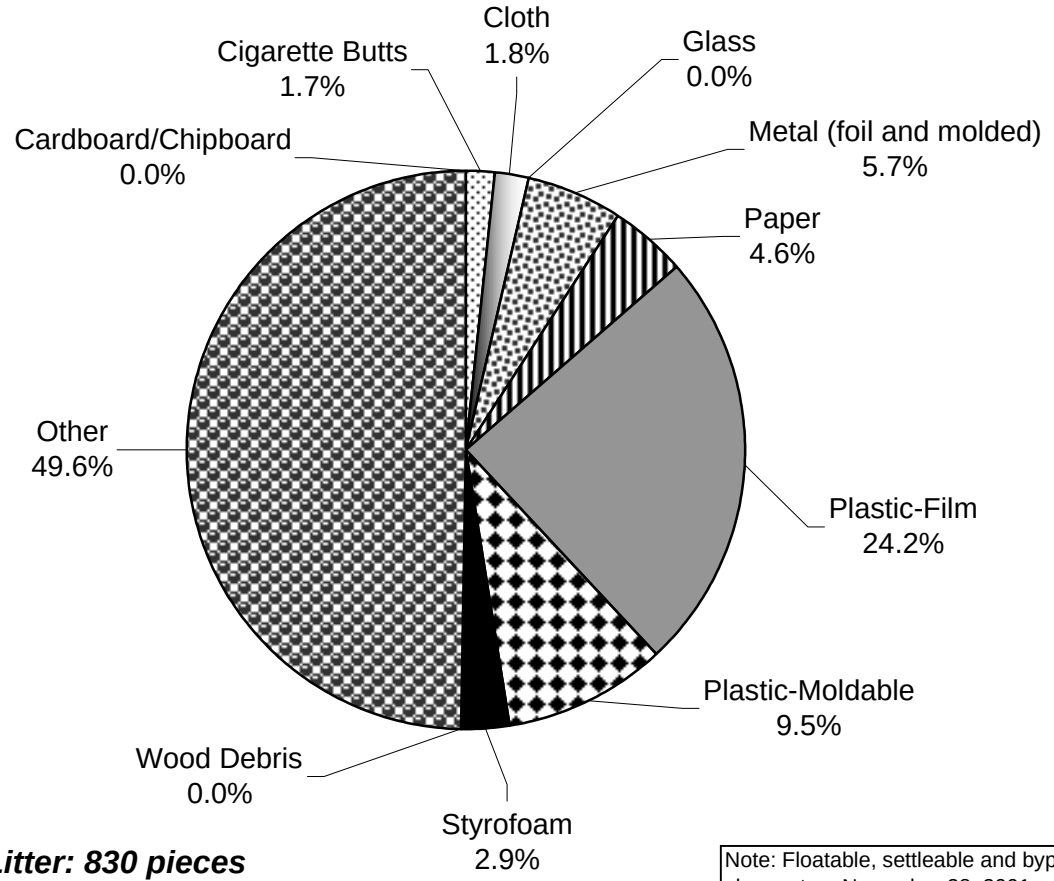


Total Mass of Settleable Litter: 1,650.9 g

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-31

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

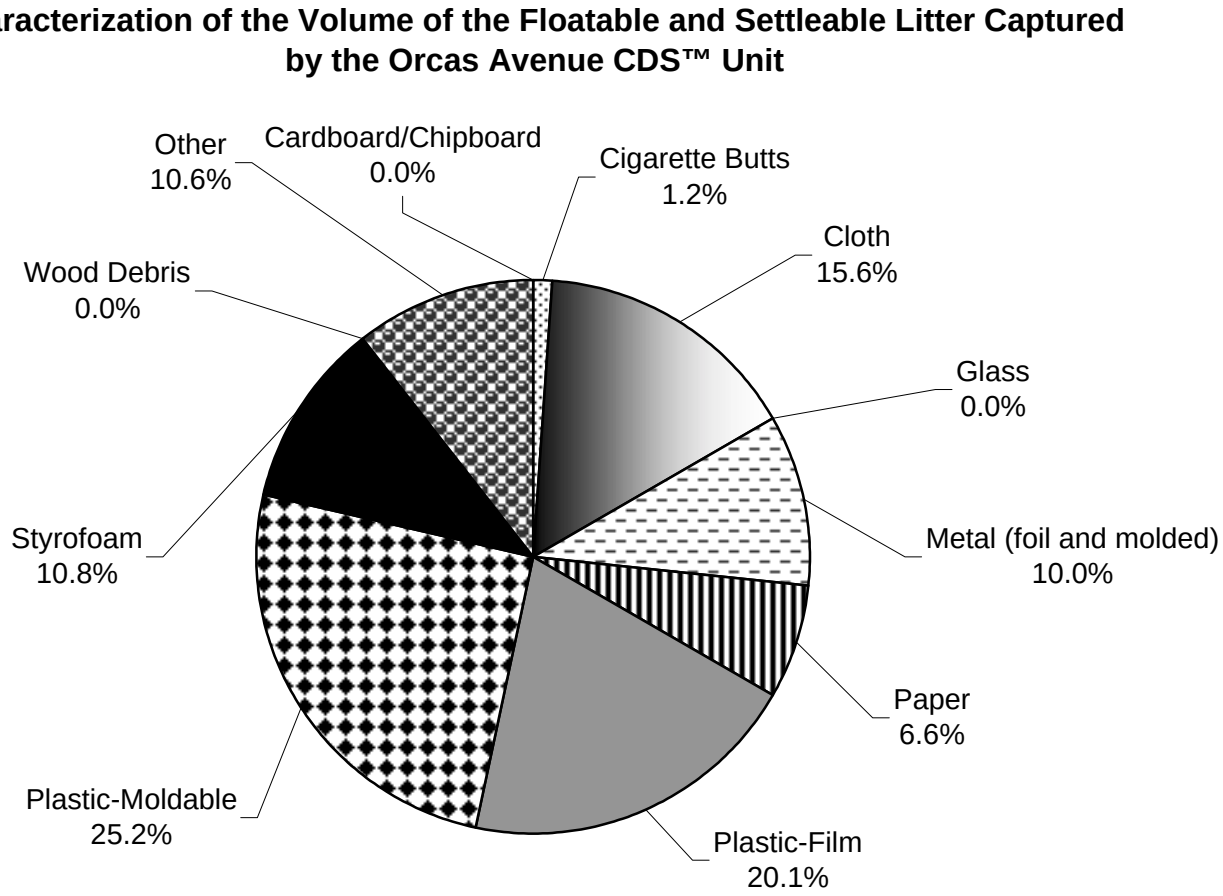


Total Count of Settleable Litter: 830 pieces

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-32

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001



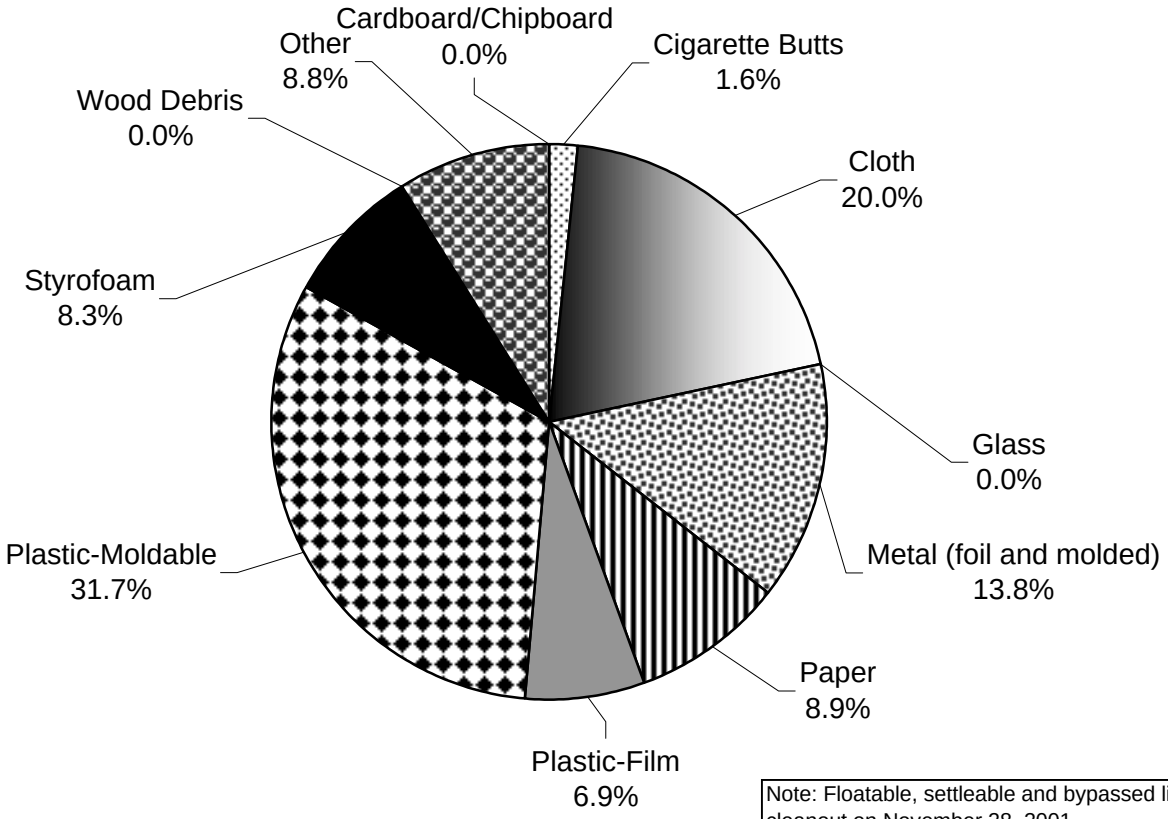
Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Total Volume of Floatable and Settleable Litter: 15,085 ml

Figure 1-33

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

Characterization of the Mass of the Floatable and Settleable Litter Captured by the Orcas Avenue CDS™ Unit

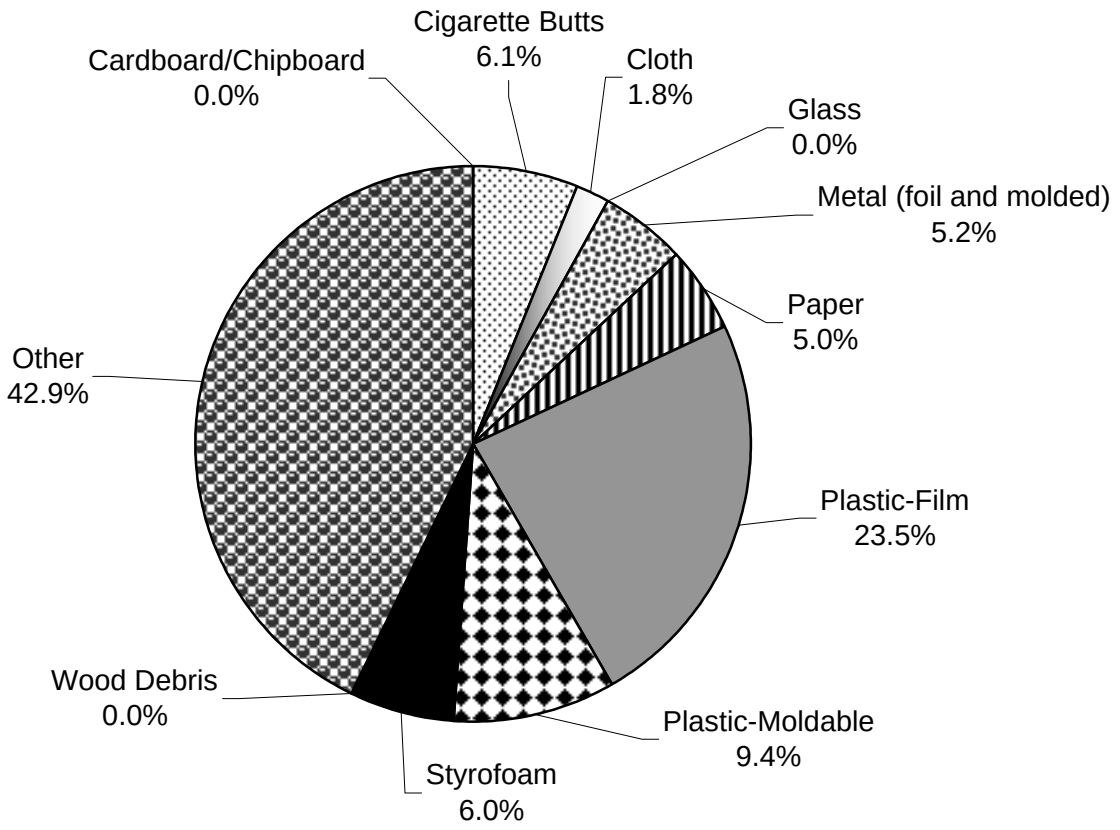


Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Total Mass of Floatable and Settleable Litter: 2,145.7 g

Figure 1-34

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

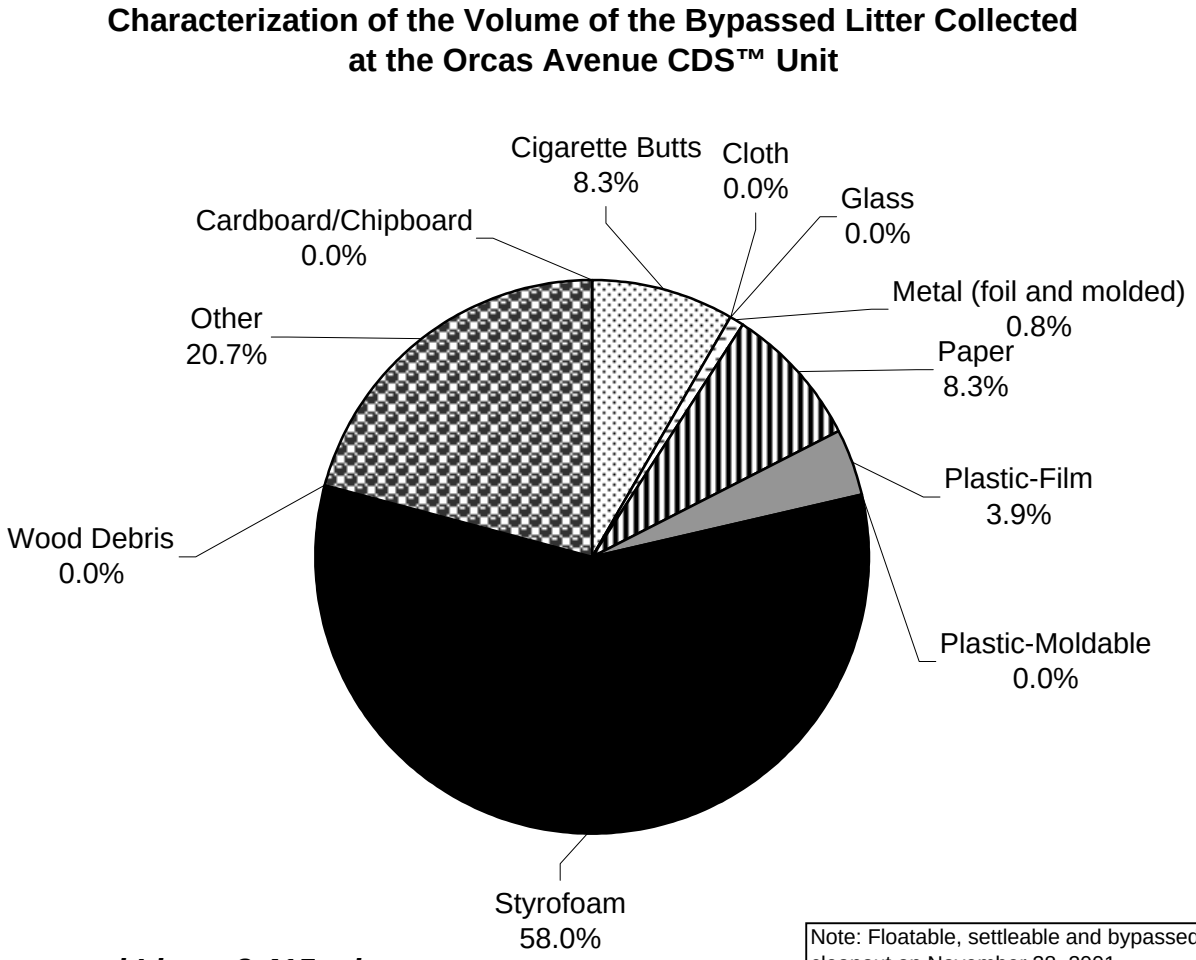


Total Count of Floatable and Settleable Litter: 960 pieces

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-35

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

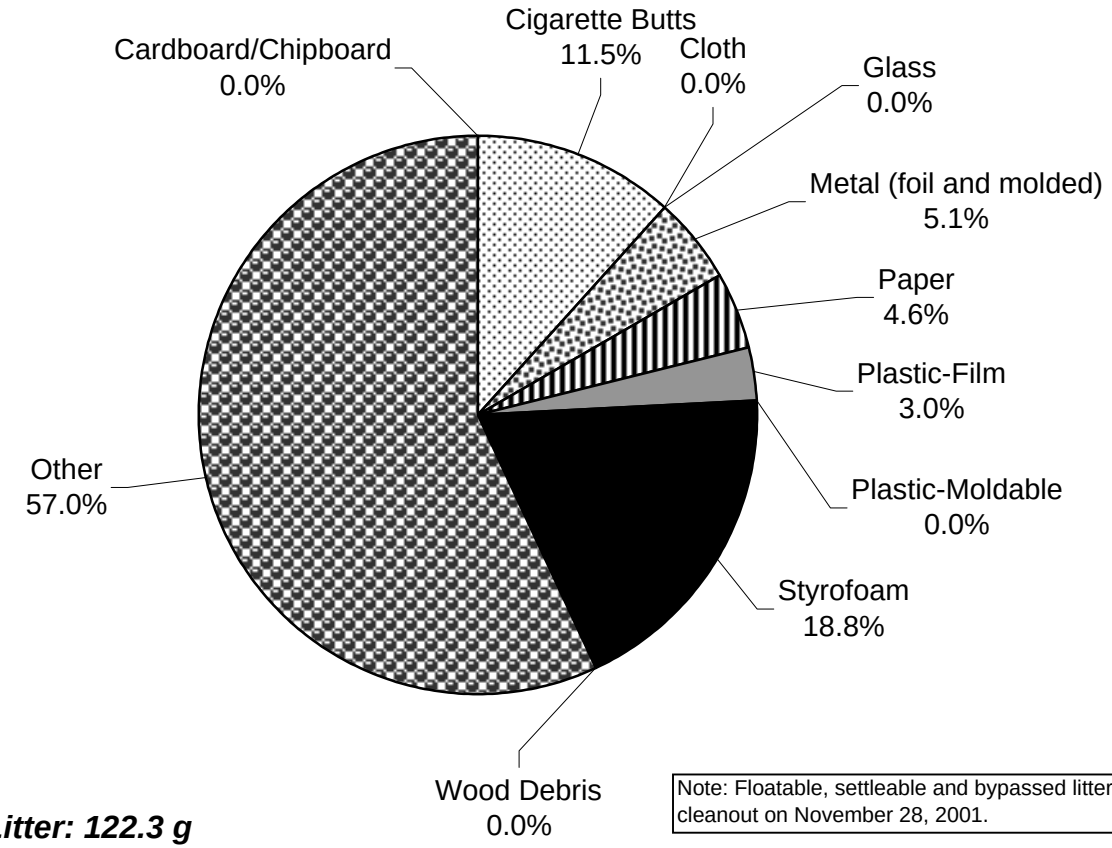


Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Total Volume of Bypassed Litter: 2,415 ml

Figure 1-36

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

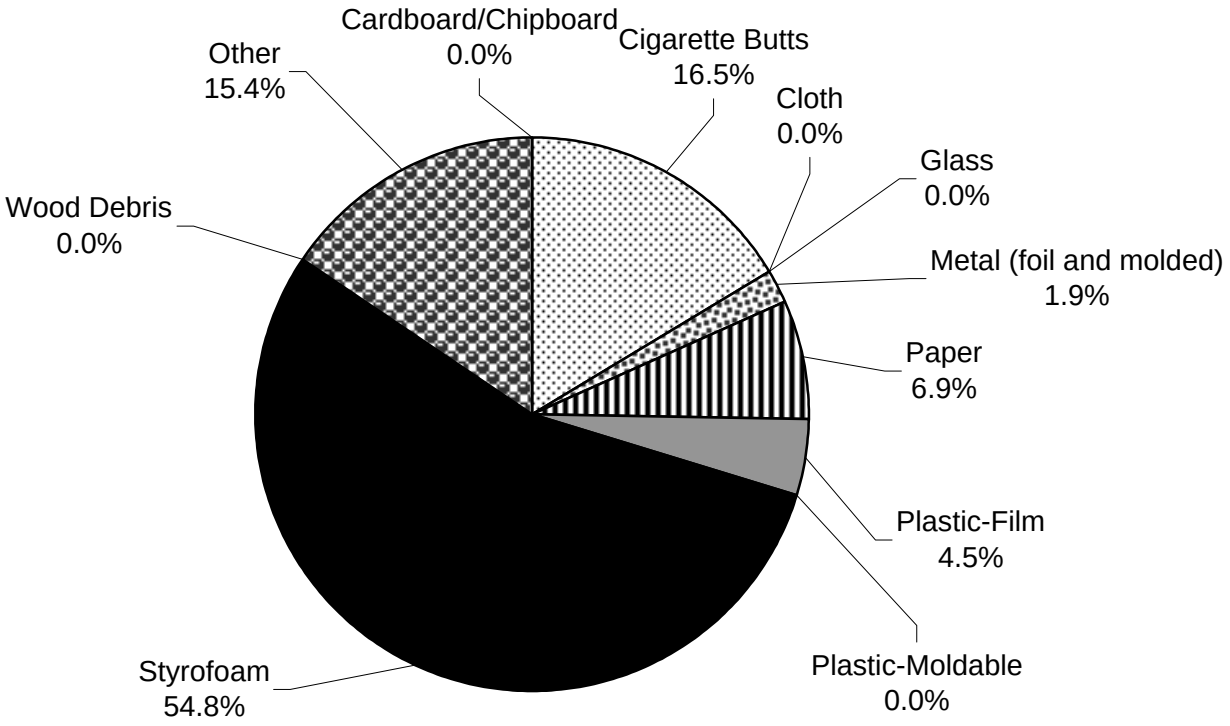


Total Mass of Bypassed Litter: 122.3 g

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-37

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001



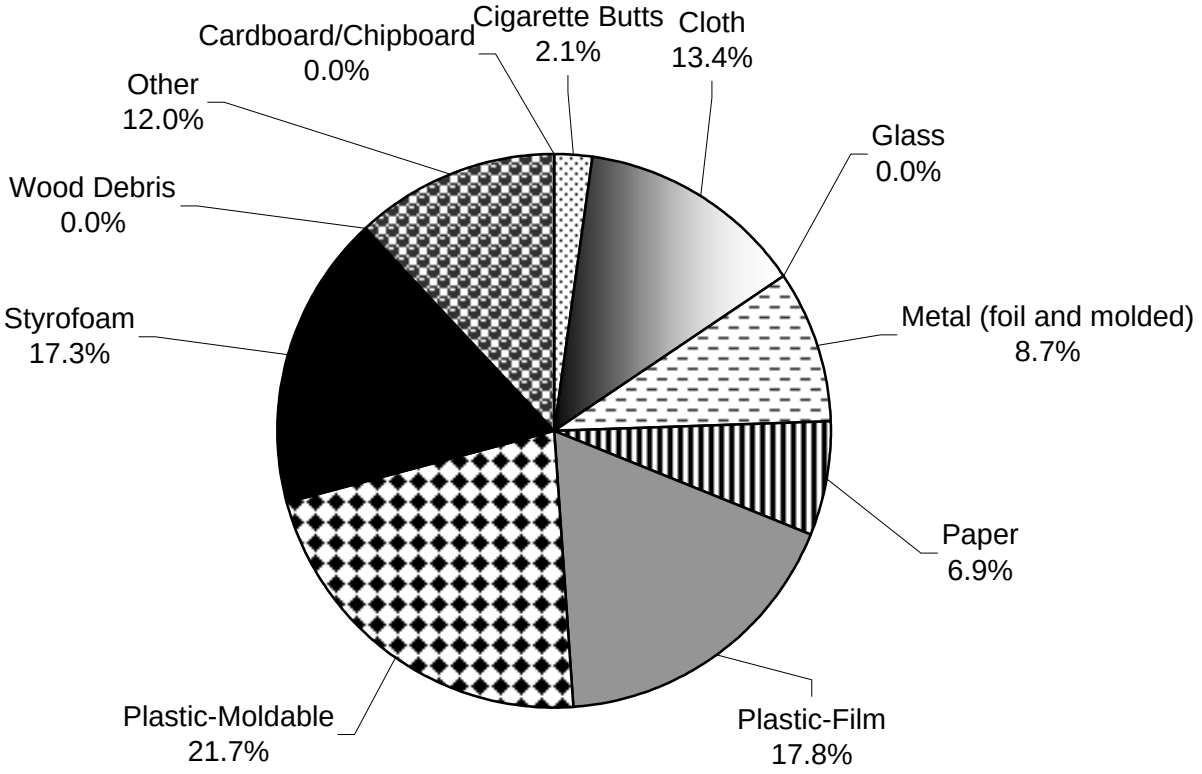
Total Count of Bypassed Litter: 376 pieces

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-38

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

Characterization of the Total Volume of the Floatable, Settleable, and Bypassed Litter Collected at the Orcas Avenue CDS™ Unit



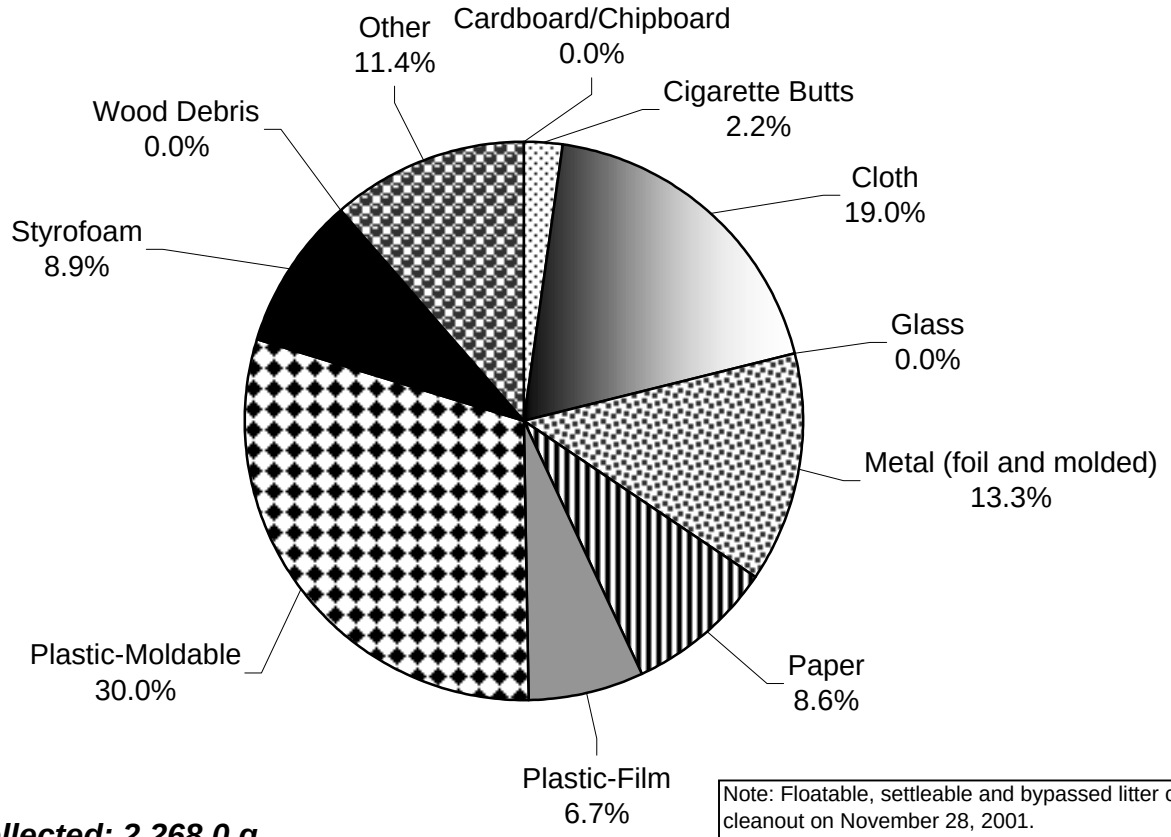
Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Total Volume of Litter Collected: 17,500 ml

Figure 1-39

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

Characterization of the Total Mass of the Floatable, Settleable, and Bypassed Litter Collected at the Orcas Avenue CDS™ Unit



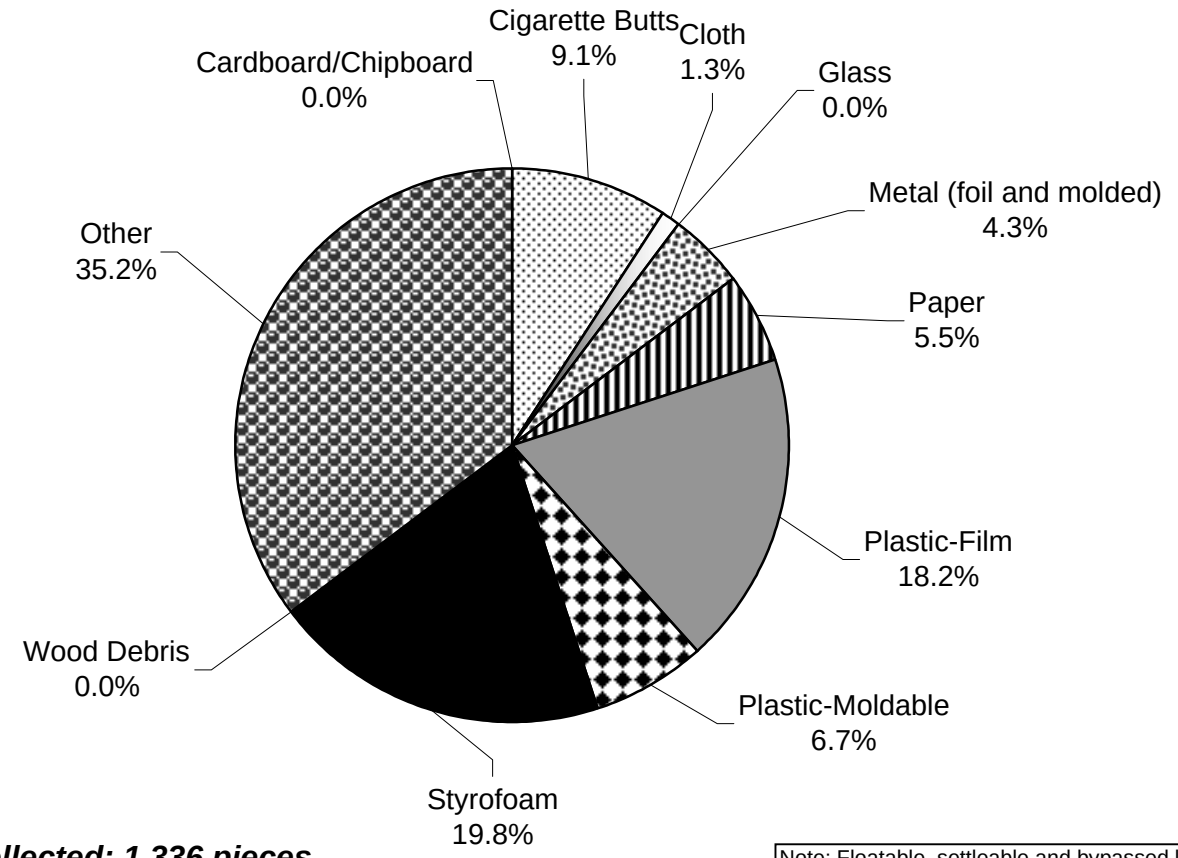
Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Total Mass of Litter Collected: 2,268.0 g

Figure 1-40

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001

Characterization of the Total Count of the Floatable, Settleable, and Bypassed Litter Collected at the Orcas Avenue CDS™ Unit



Total Count of Litter Collected: 1,336 pieces

Note: Floatable, settleable and bypassed litter collected during cleanout on November 28, 2001.

Figure 1-41

Gross Pollutant Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 9, 2002

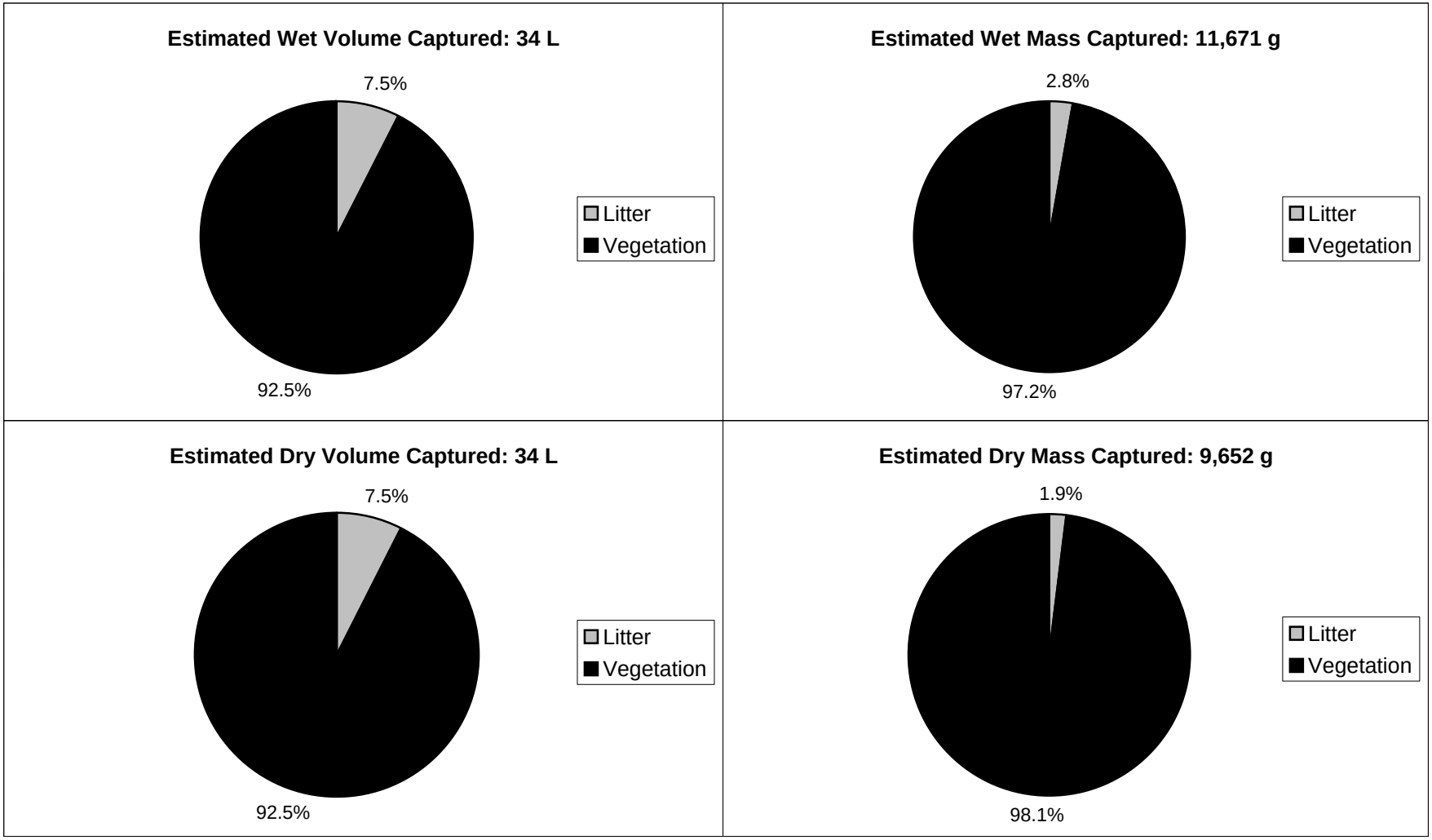
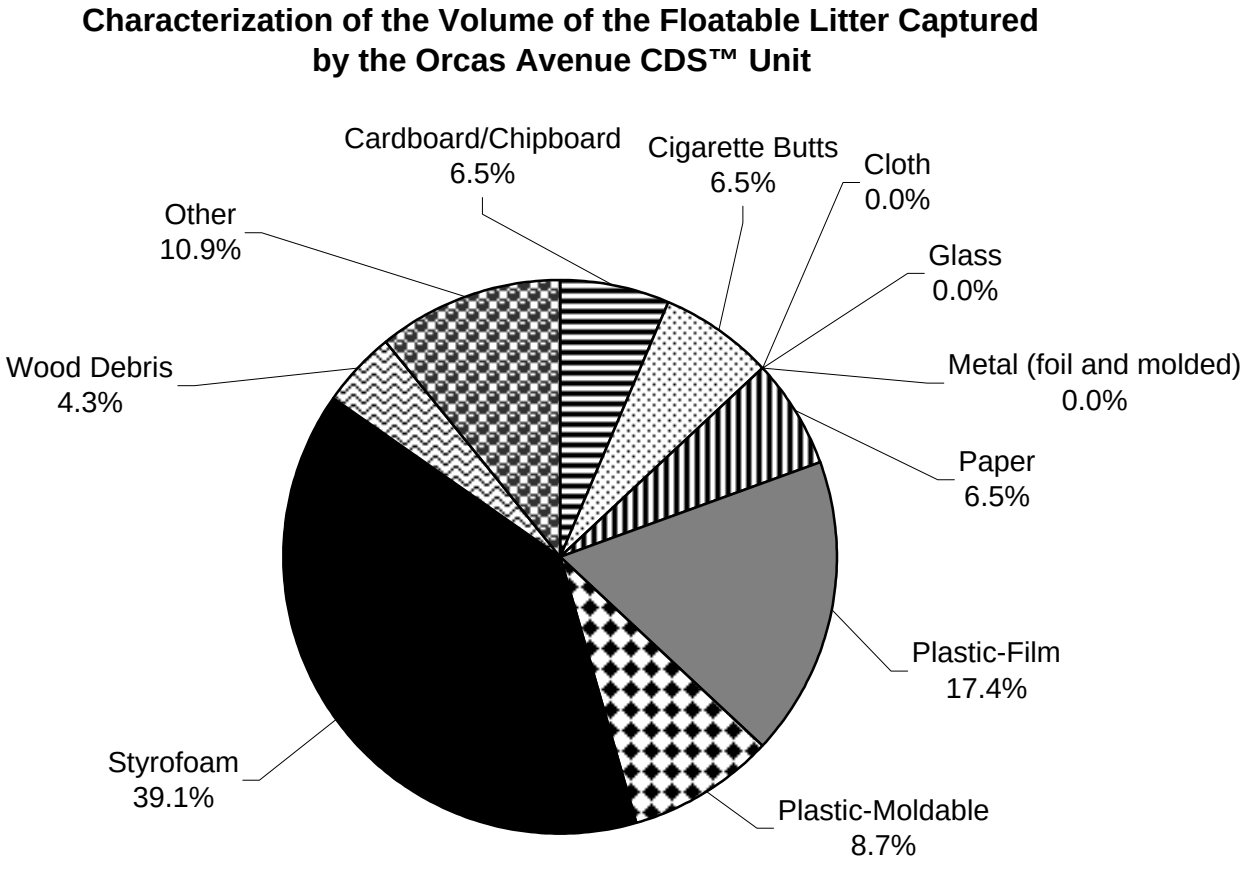


Figure 1-42

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 9, 2002

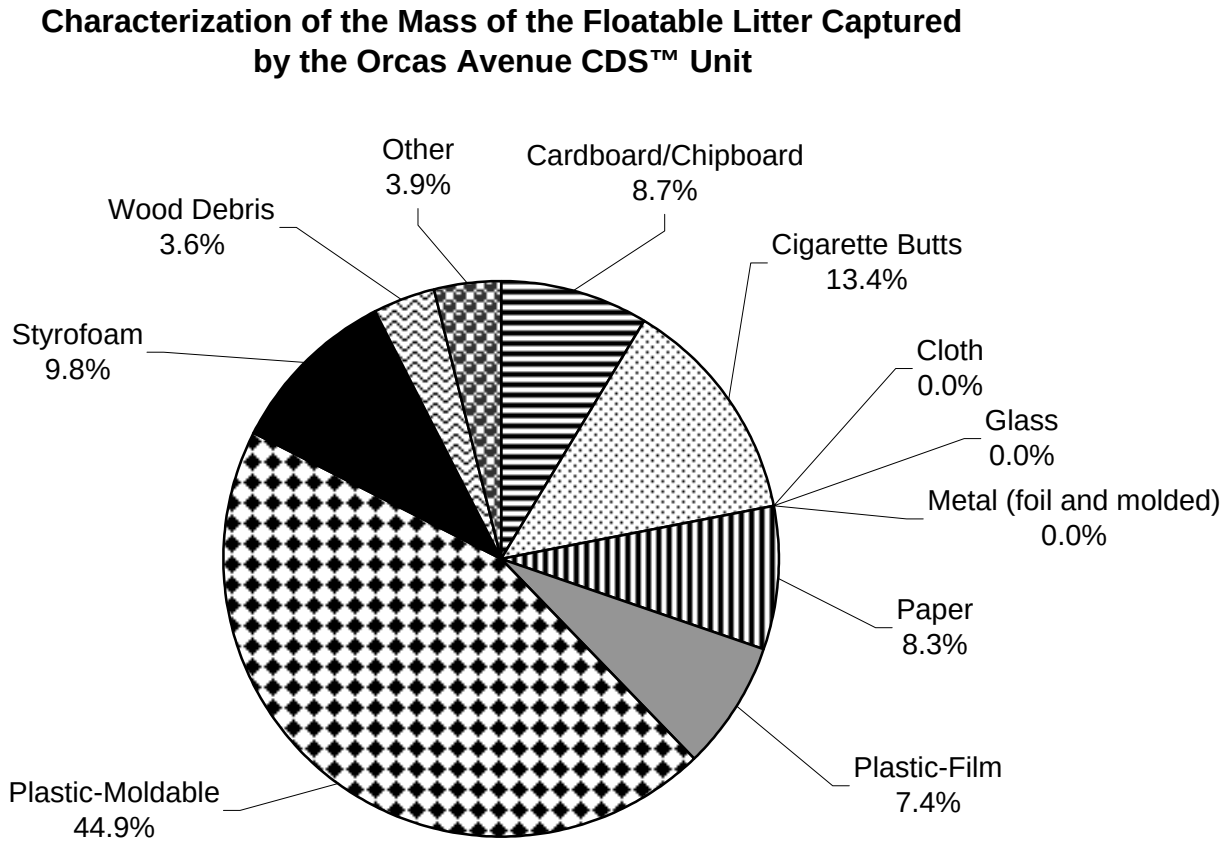


Total Volume of Floatable Litter: 2,300 ml

Note: Only floatable litter collected during cleanout on January 9, 2002.

Figure 1-43

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 9, 2002

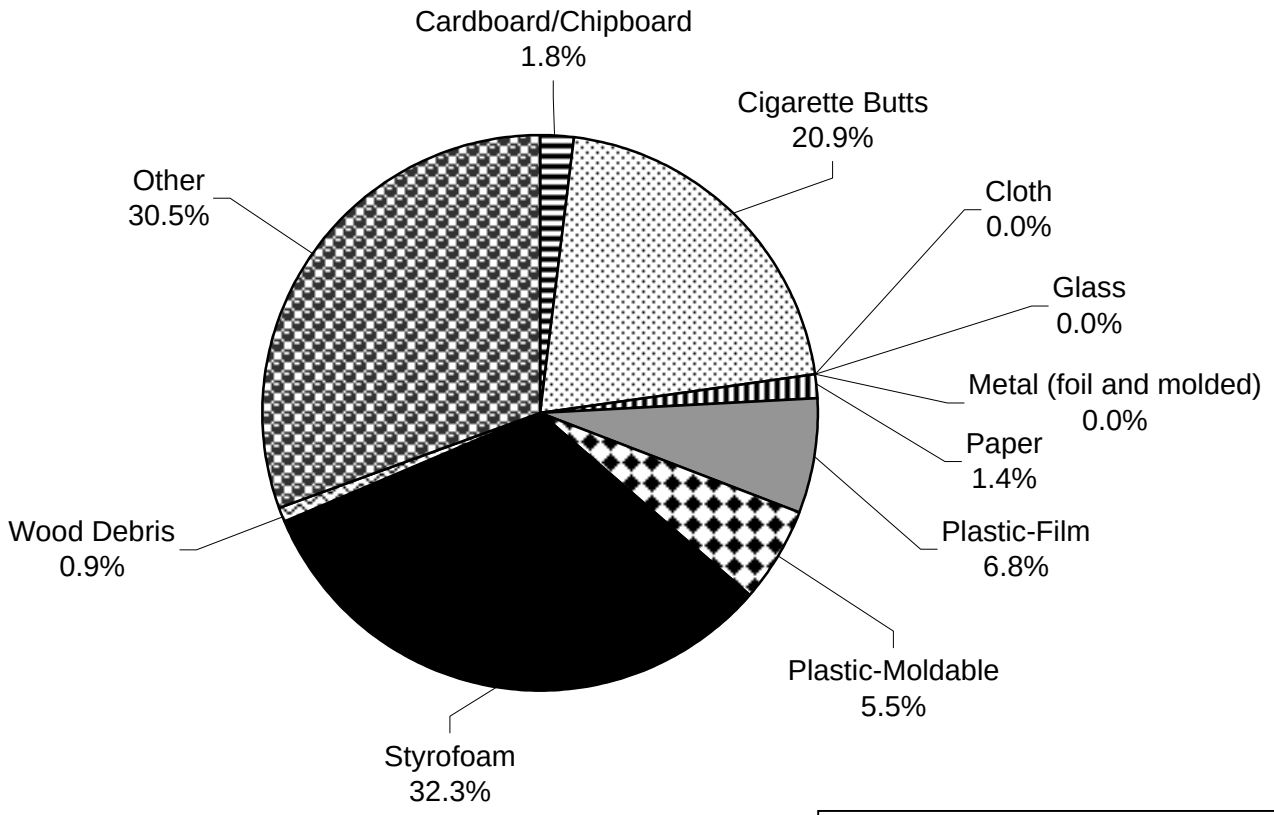


Total Mass of Floatable Litter: 244.1g

Note: Only floatable litter collected during cleanout on January 9, 2002.

Figure 1-44

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 9, 2002



Total Count of Floatable Litter: 220 pieces

Note: Only floatable litter collected during cleanout on January 9, 2002.

Figure 1-45

Gross Pollutant Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

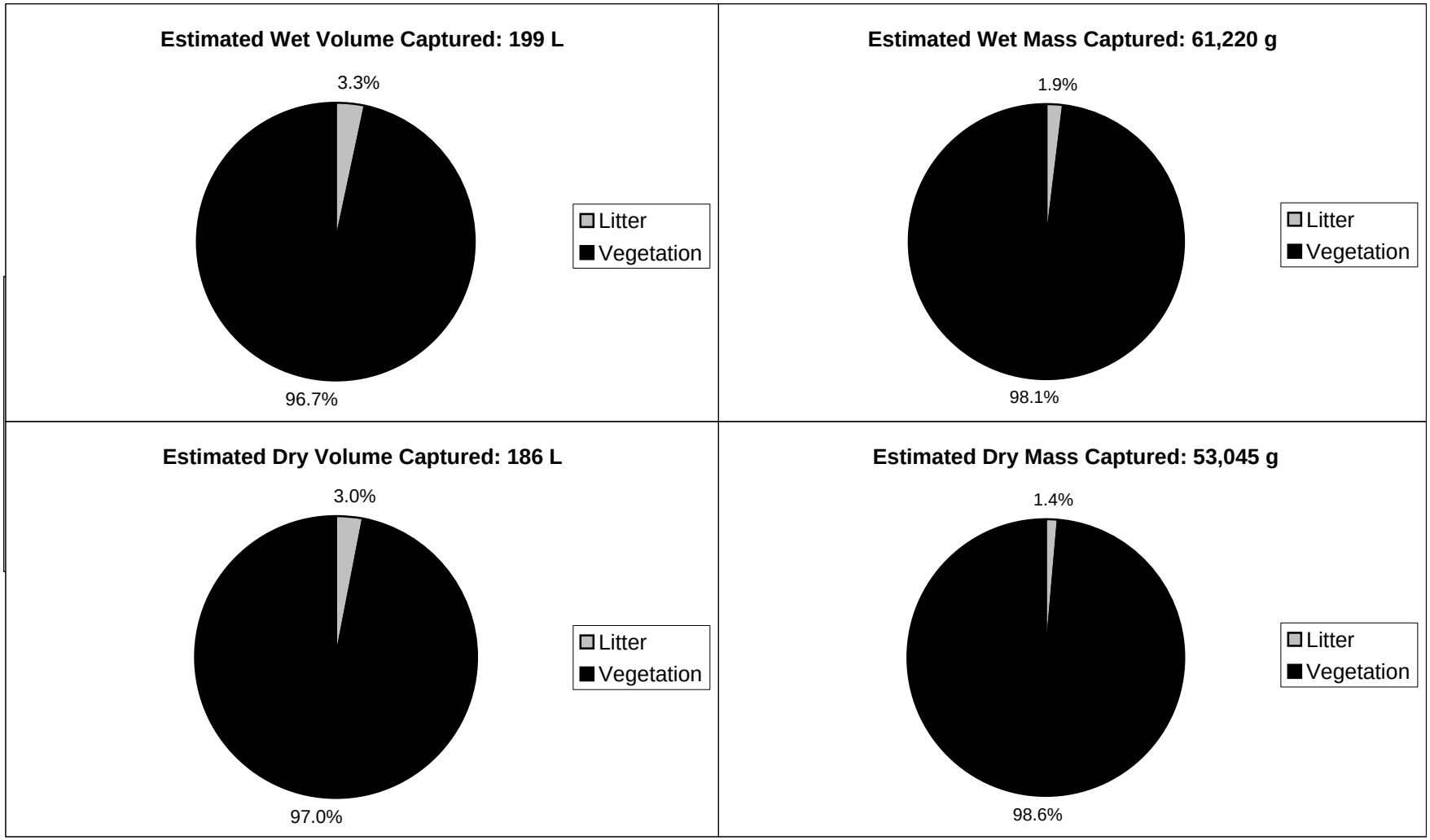
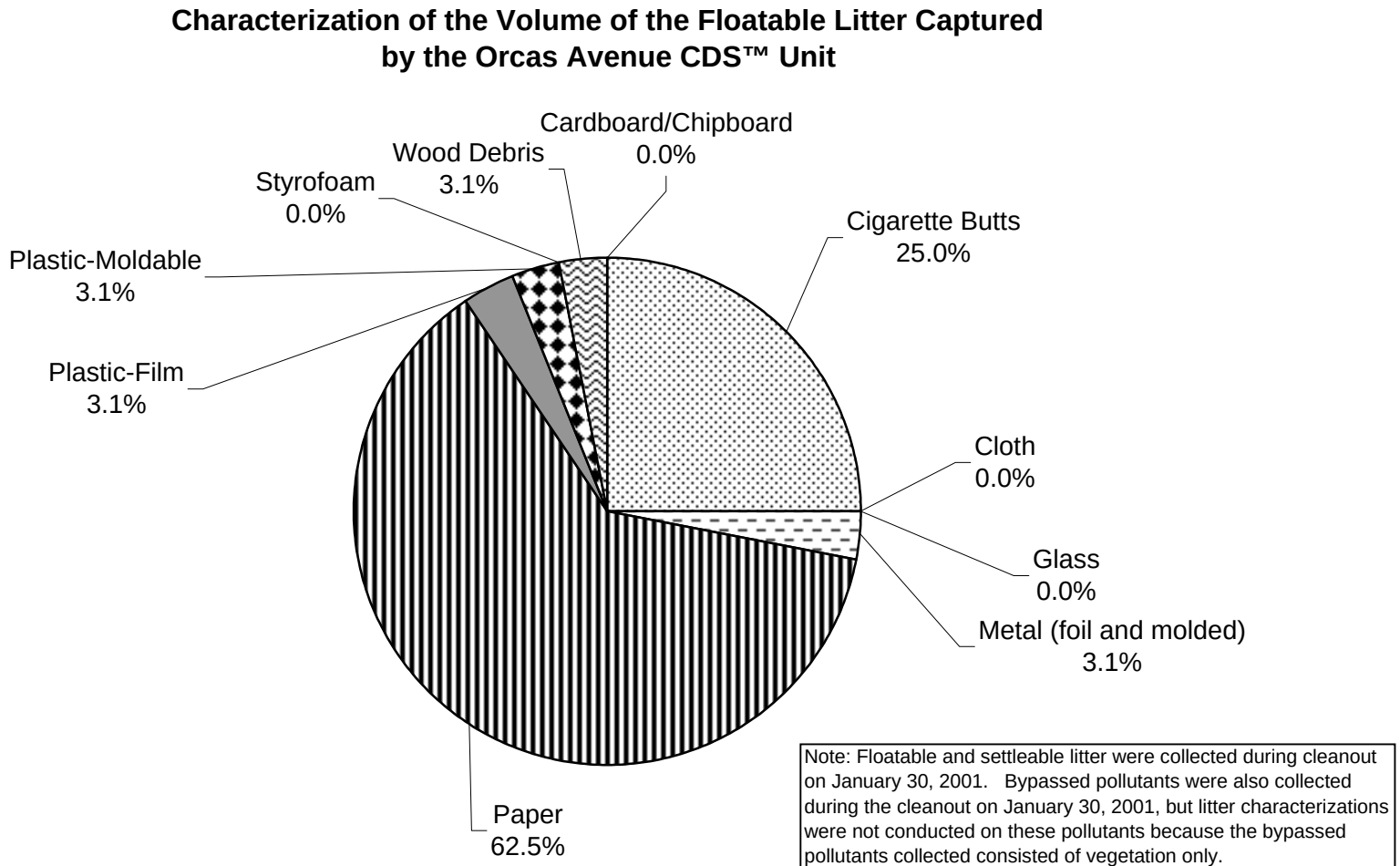


Figure 1-46

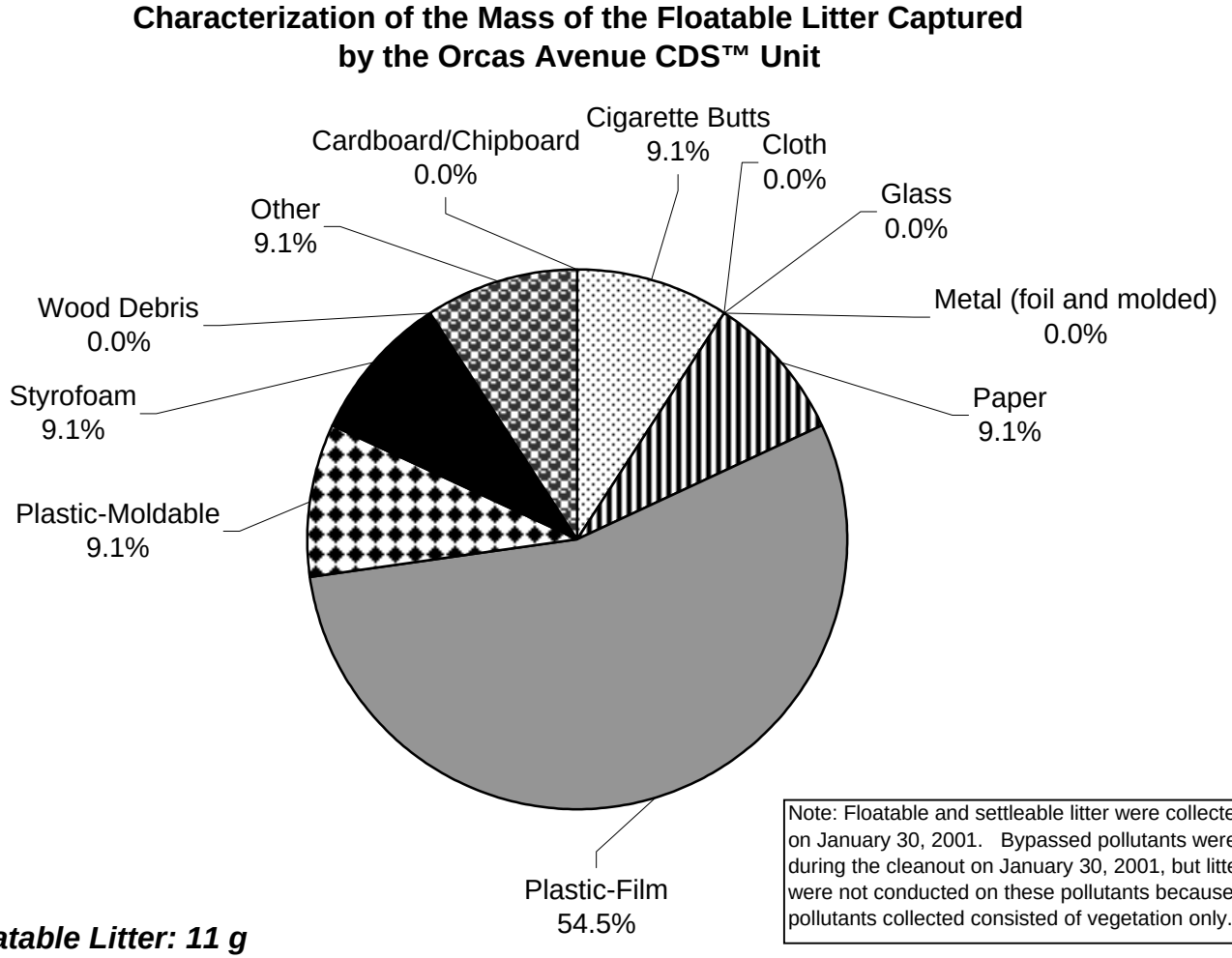
Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002



Total Volume of Floatable Litter: 32 ml

Figure 1-47

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

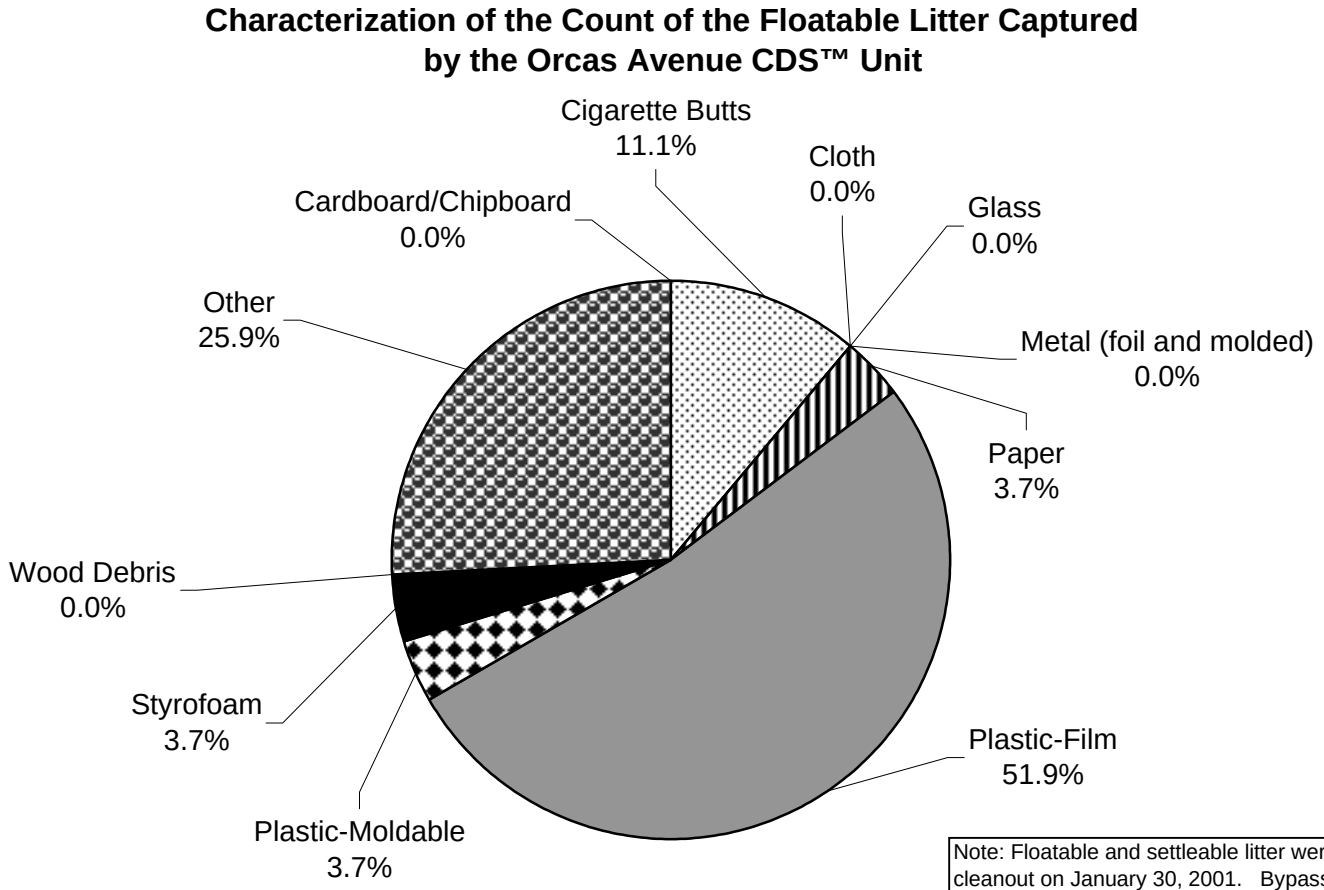


Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Mass of Floatable Litter: 11 g

Figure 1-48

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

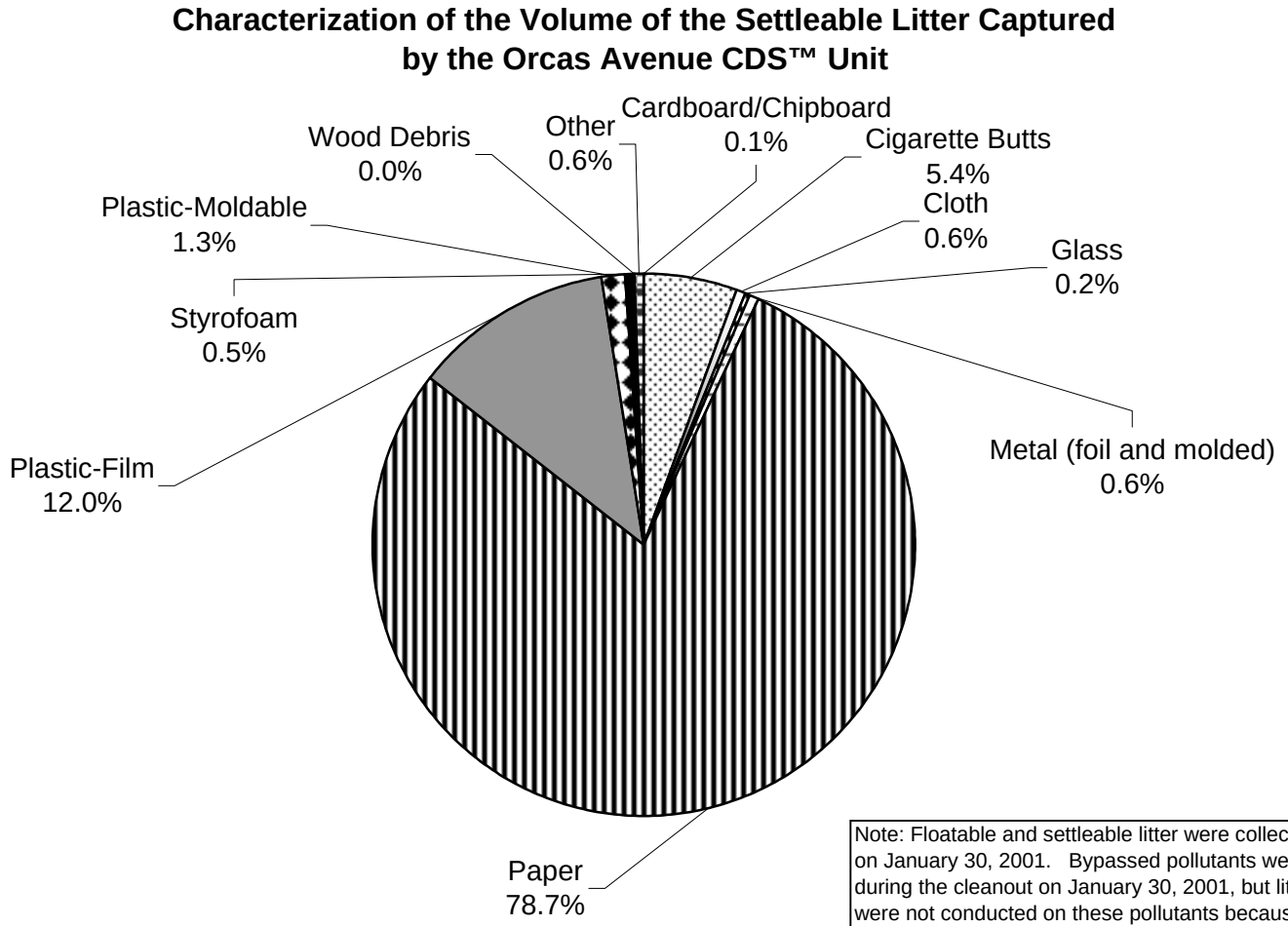


Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants,because the bypassed pollutants collected consisted of vegetation only.

Total Count of Floatable Litter: 27 pieces

Figure 1-49

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

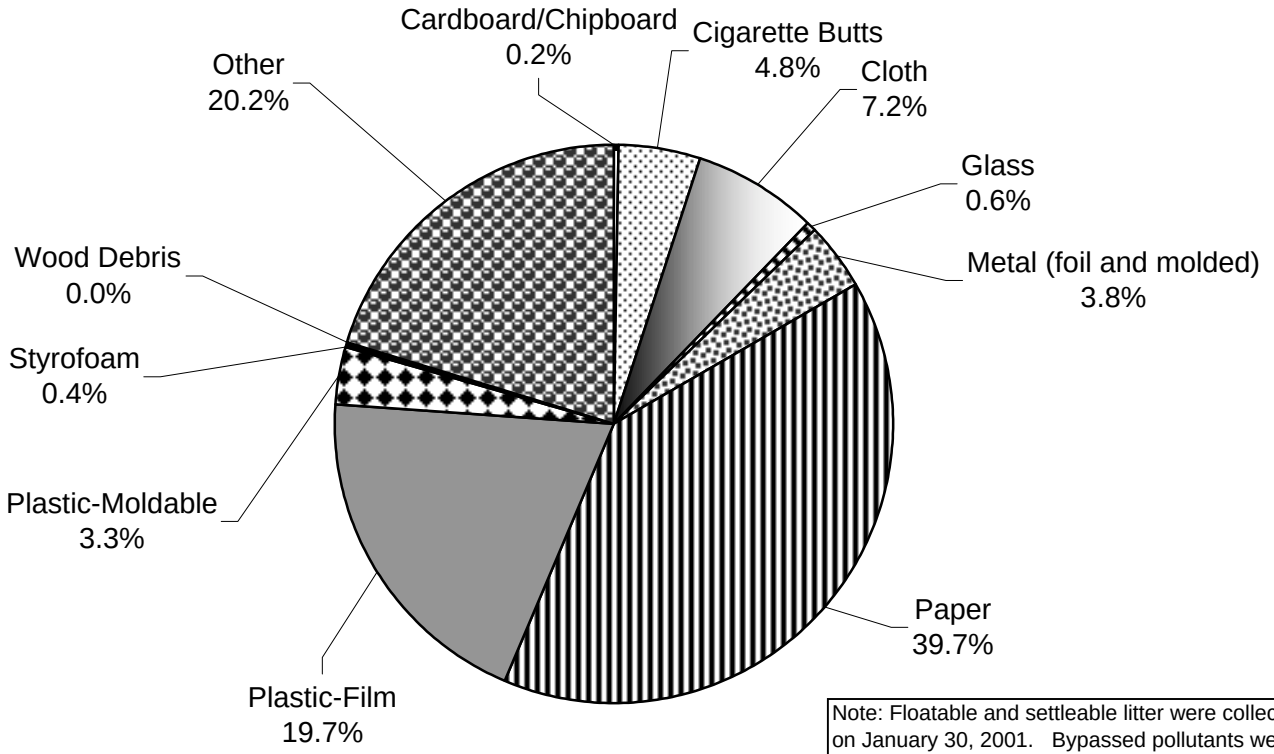


Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Volume of Settleable Litter: 4,192 ml

Figure 1-50

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

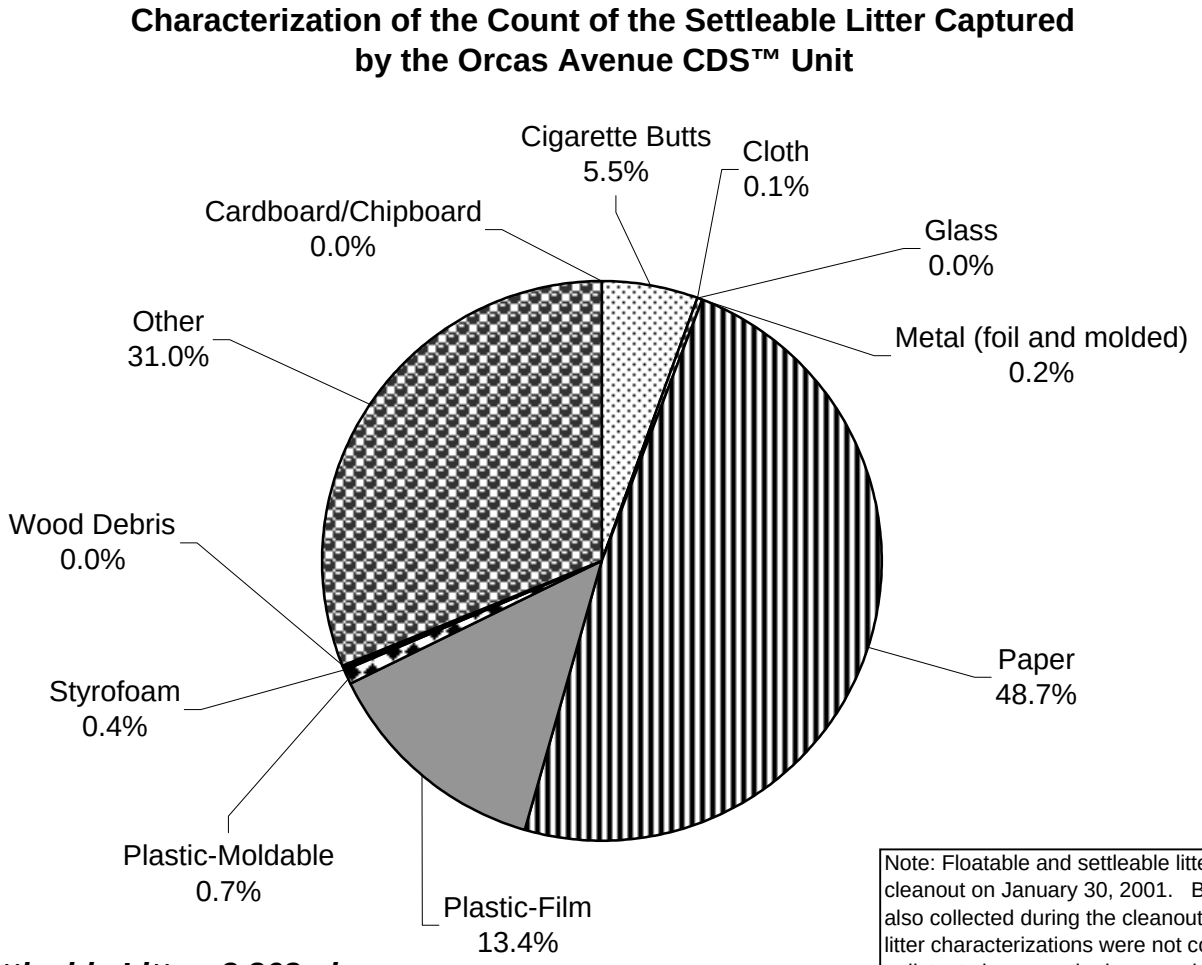


Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Mass of Settleable Litter: 1,411 g

Figure 1-51

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

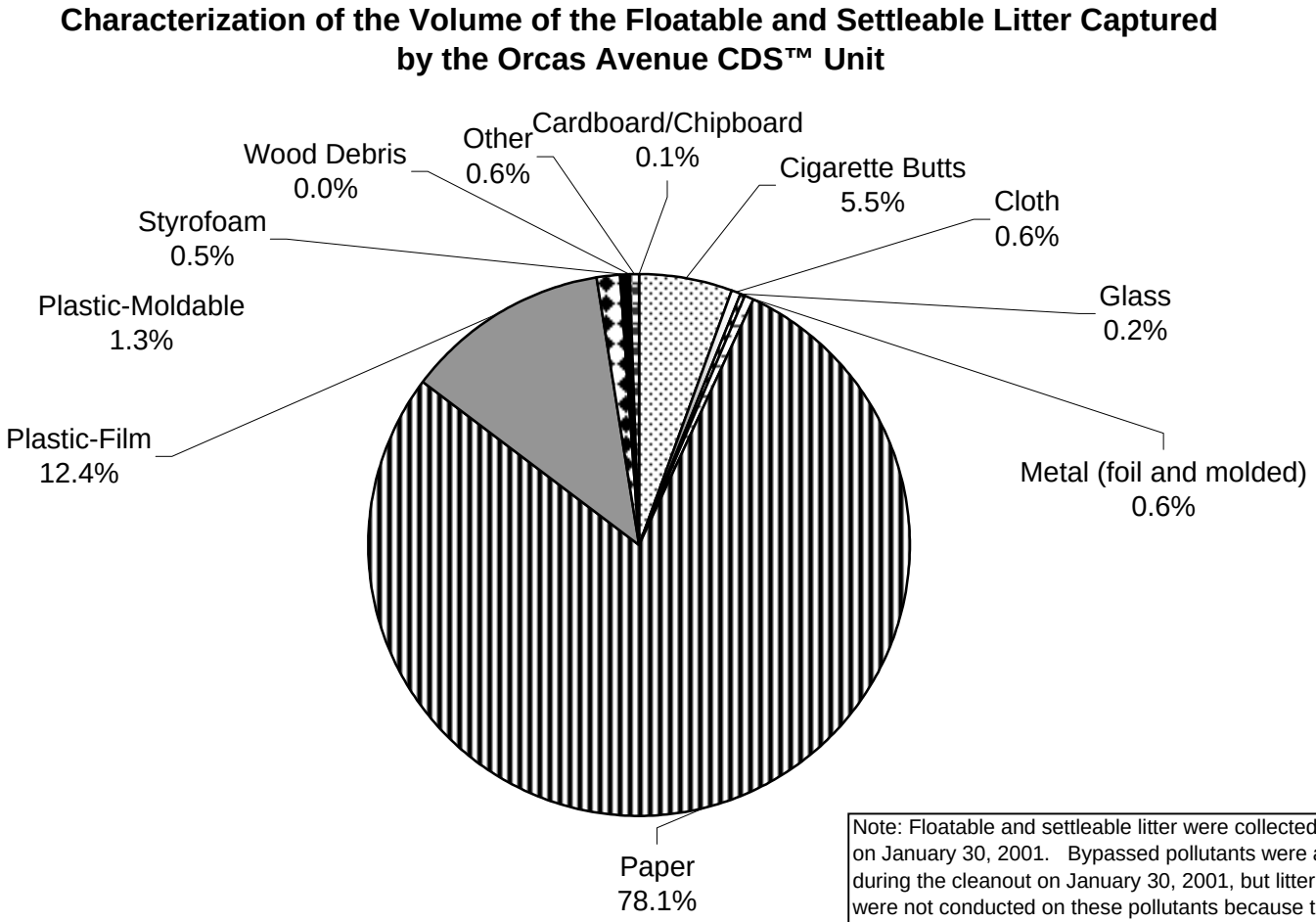


Total Count of Settleable Litter: 3,268 pieces

Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Figure 1-52

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002



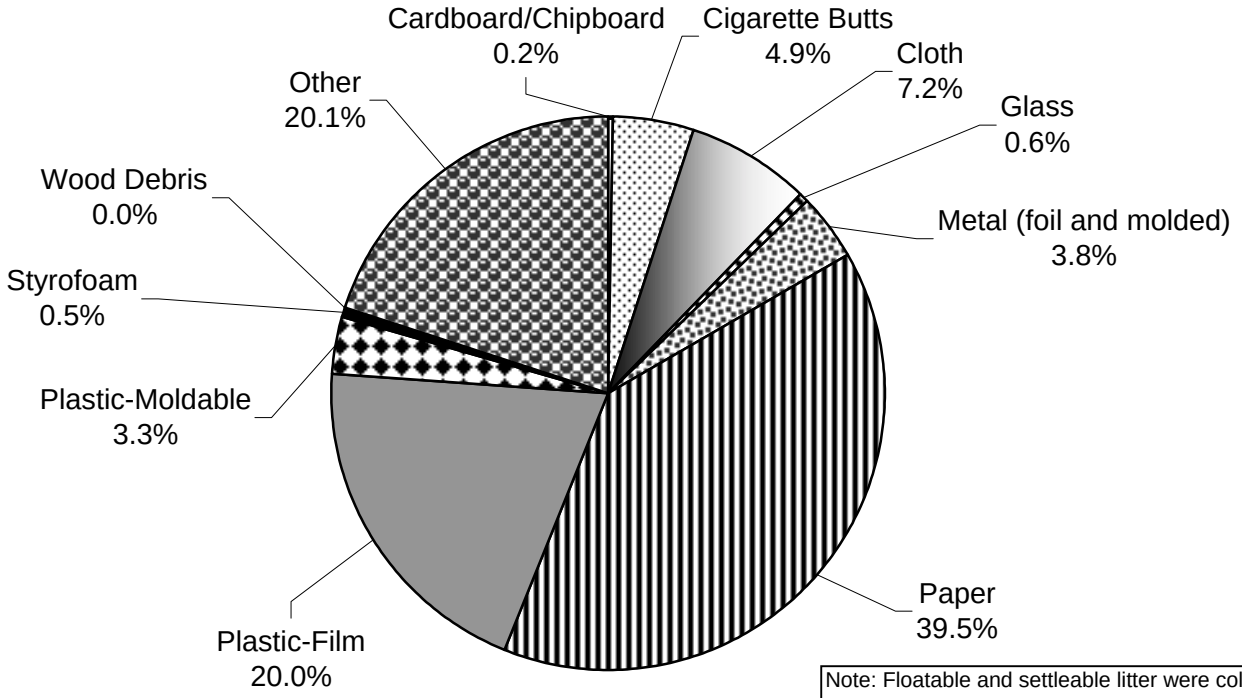
Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Volume of Floatable and Settleable Litter: 4,221 ml

Figure 1-53

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

Characterization of the Mass of the Floatable and Settleable Litter Captured by the Orcas Avenue CDS™ Unit



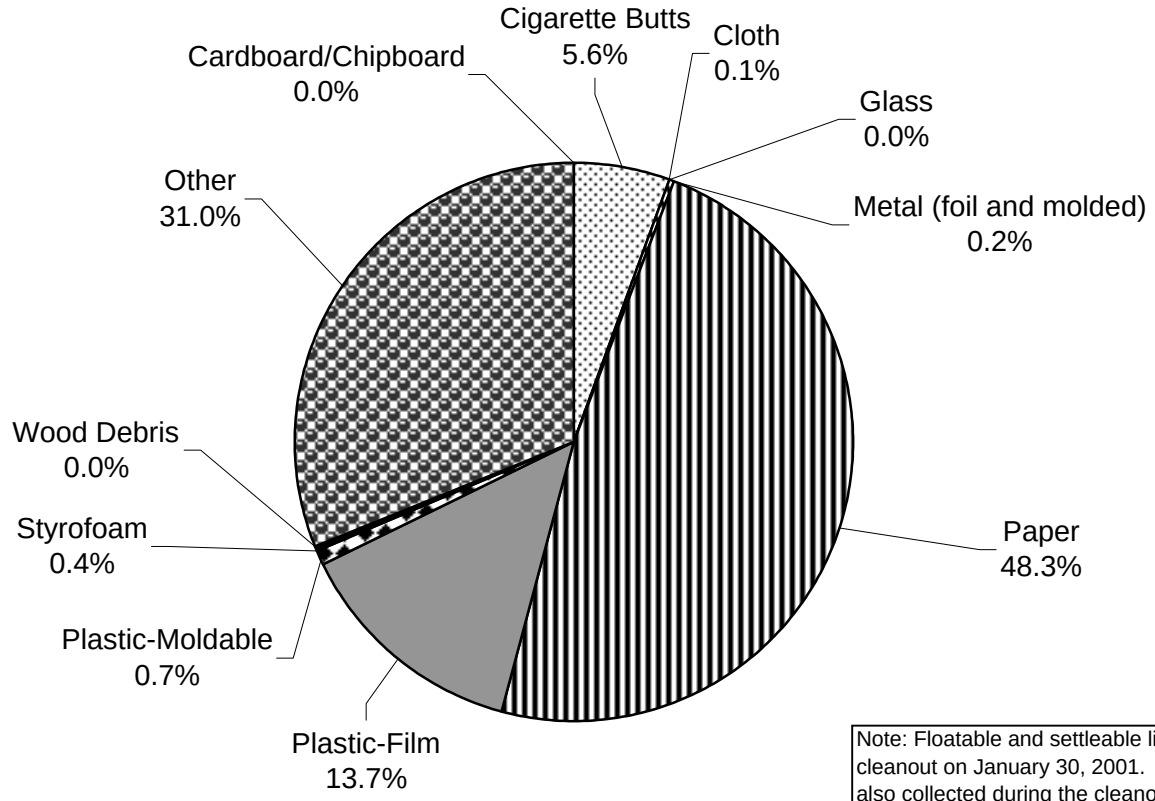
Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Mass of Floatable and Settleable Litter: 1,422 g

Figure 1-54

Gross Litter Characterization for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 2002

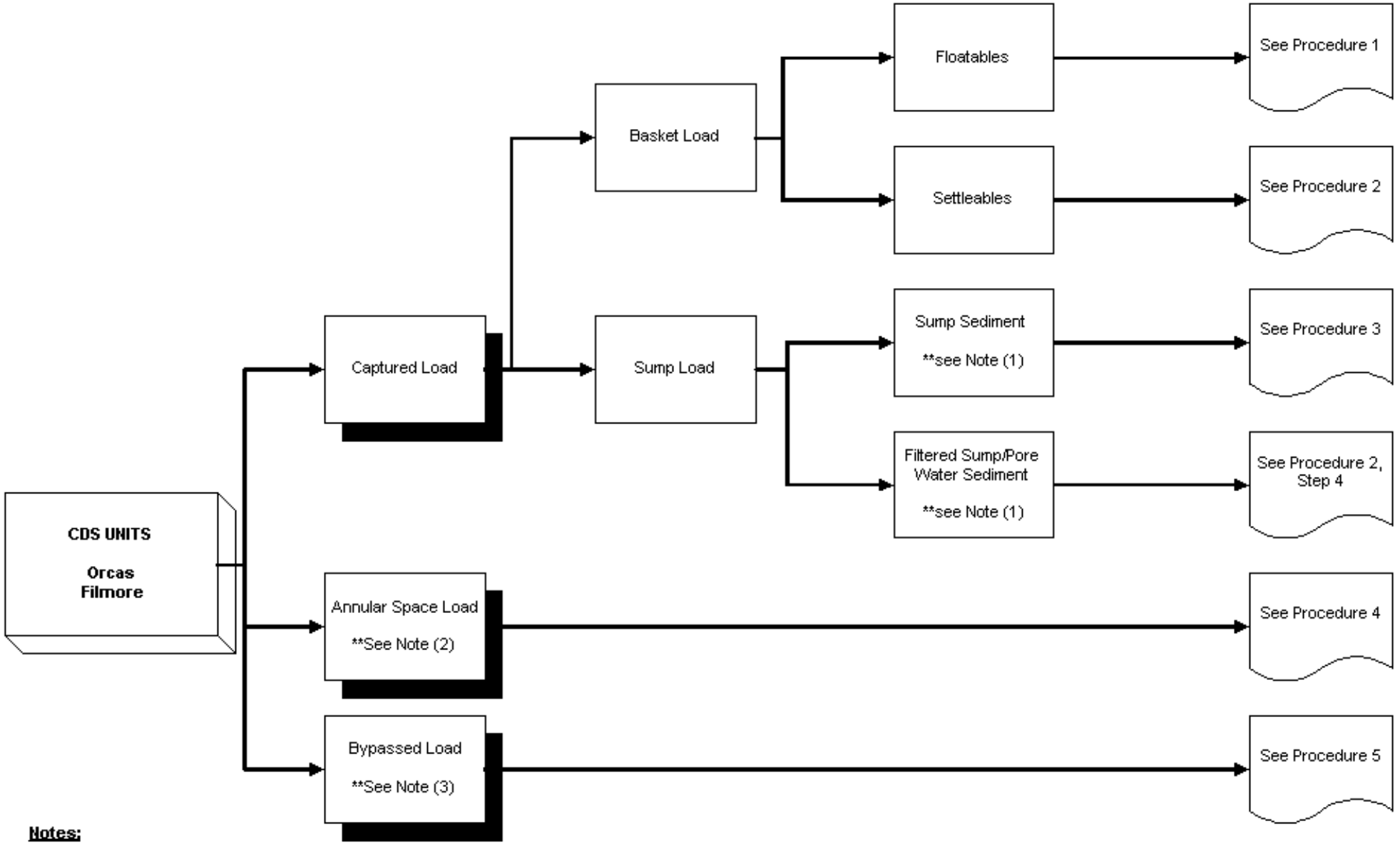
Characterization of the Count of the Floatable and Settleable Litter Captured by the Orcas Avenue CDS™ Unit



Note: Floatable and settleable litter were collected during cleanout on January 30, 2001. Bypassed pollutants were also collected during the cleanout on January 30, 2001, but litter characterizations were not conducted on these pollutants because the bypassed pollutants collected consisted of vegetation only.

Total Count of Floatable and Settleable Litter: 3,295 pieces

FIGURE 1-55
CDS LITTER LABORATORY PROCEDURE FLOWCHART



Notes:

(1) As agreed upon by CDS and Caltrans druing the May 6, 2002 cleanout of the Orcas CDS Unit, the sump sediment was combined with the Basket Load settleables in the field. Therefore, Procedure 3 does not apply to the Orcas CDS Unit sump sediment load (Procedure 1 to be followed for the combined settleables, sump sediment, and filtered pore water sediment load). For the Filmore CDS Unit cleanout on April 25, 2002, the sump sediment was not combined with the Basket Load settelables. Therefore, Procedure 3 applies to the separated Filmore CDS sump sediment load.

(2) During the May 6, 2002 cleanout of the Orcas CDS Unit, the annular space sediment was observed to contain vegetation - a sign that the annular space load may contain material that overflowed from the top of the CDS unit. Consequently, Caltrans and CDS agreed that the annular space load would not be representative of what passes through the basket screen and should be discarded. The annular space load for Orcas did not have any obvious signs of overflow and was, therefore, delivered to the litter laboratory in a separate container for characterization per Procedure 4.

(3) During the May 6, 2002 cleanout of the Orcas CDS Unit, no bypass material was observed. Therefore, no bypass material was collected for characterization. By-pass material was observed, however, during the April 25, 2002 cleanout of the Filmore CDS Unit. Therefore, a bypass sample was collected for characterization per Procedure 5.

FIGURE 1-56
PROCEDURE 1 - CAPTURED LOAD - FLOATABLES

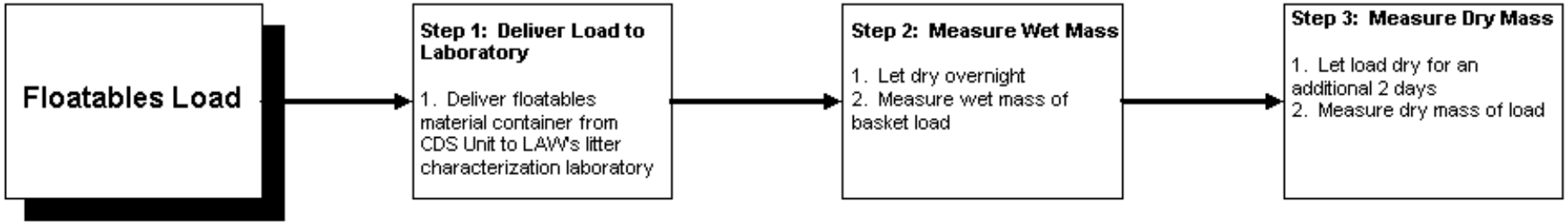


FIGURE 1-57
PROCEDURE 2 - CAPTURED LOAD - SETTLEABLES

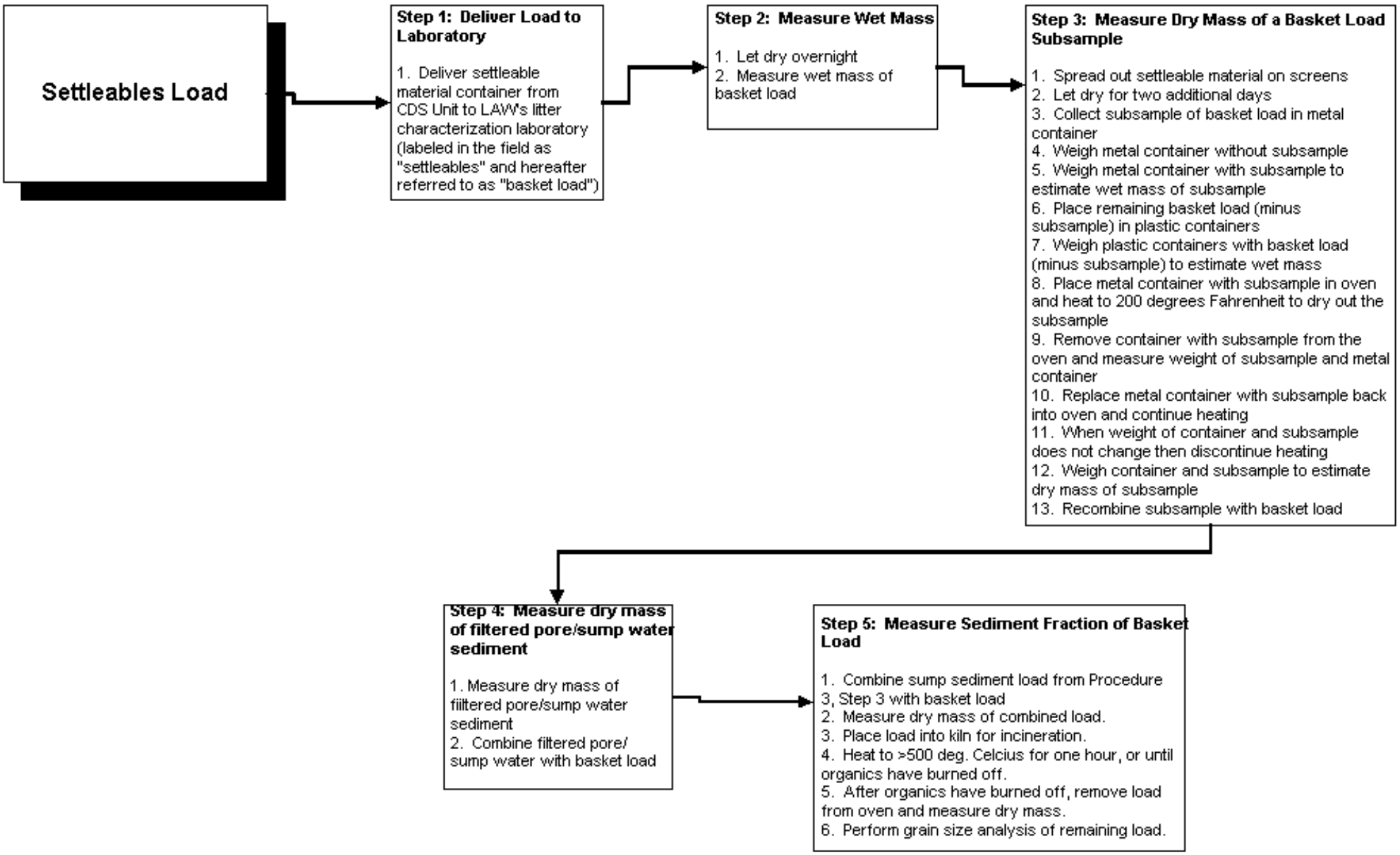


FIGURE 1-58
PROCEDURE 3 - CAPTURED LOAD - SUMP SEDIMENT

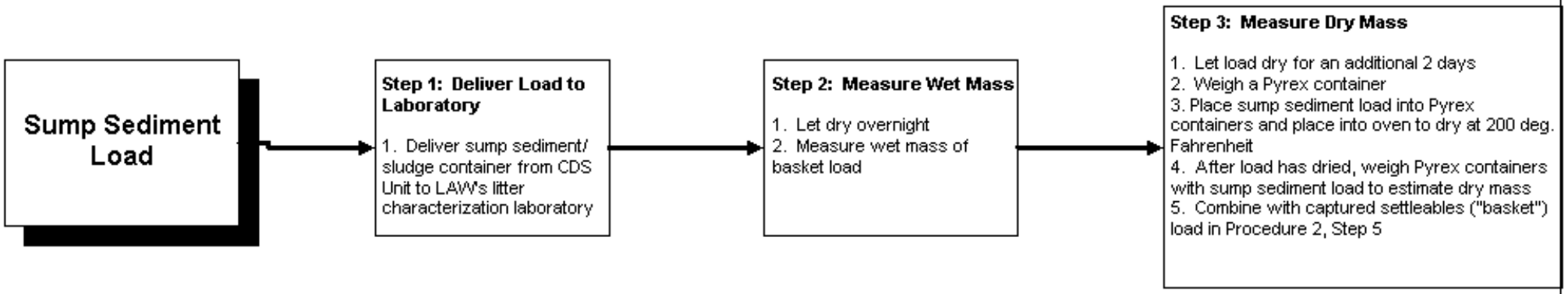


FIGURE 1-59
PROCEDURE 4 - ANNULAR SPACE LOAD

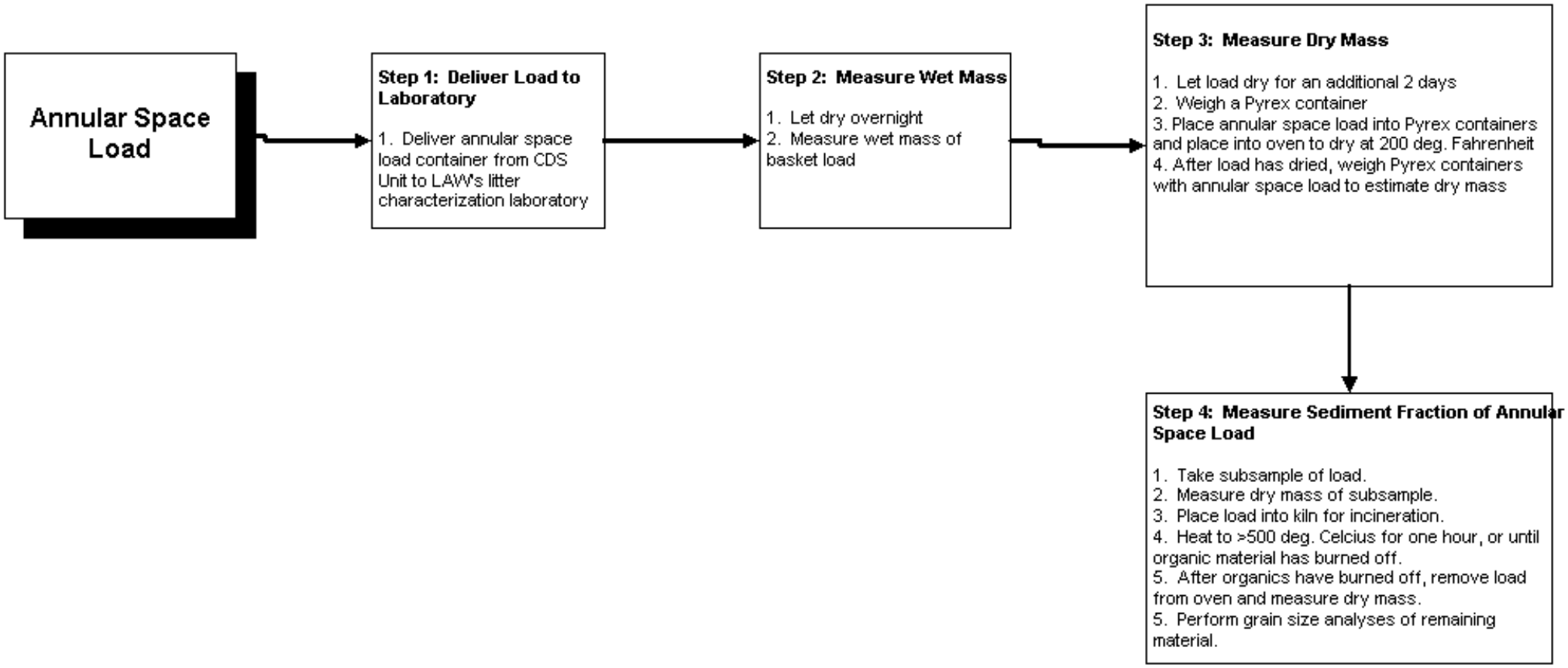


FIGURE 1-60
PROCEDURE 5 - BYPASSED LOAD

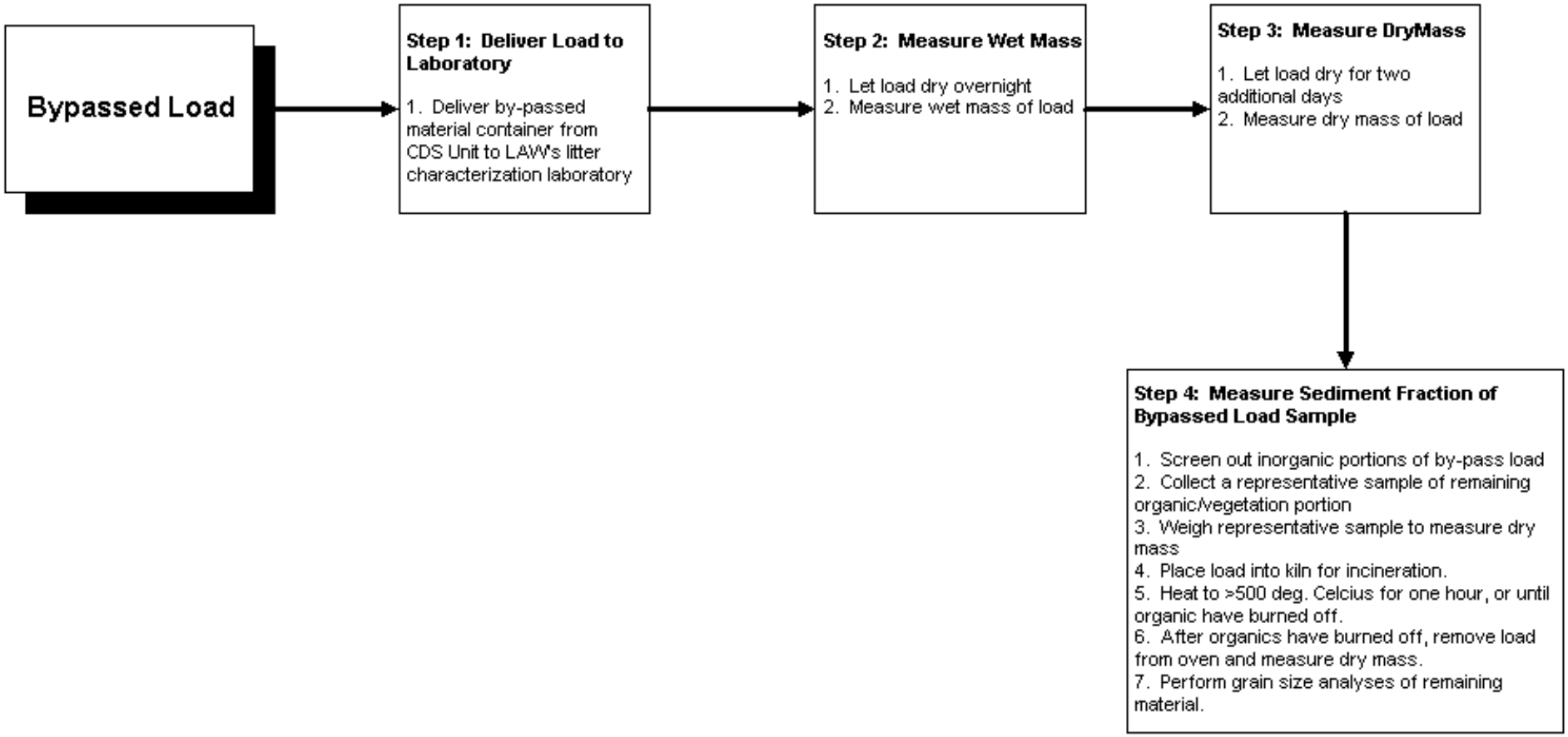
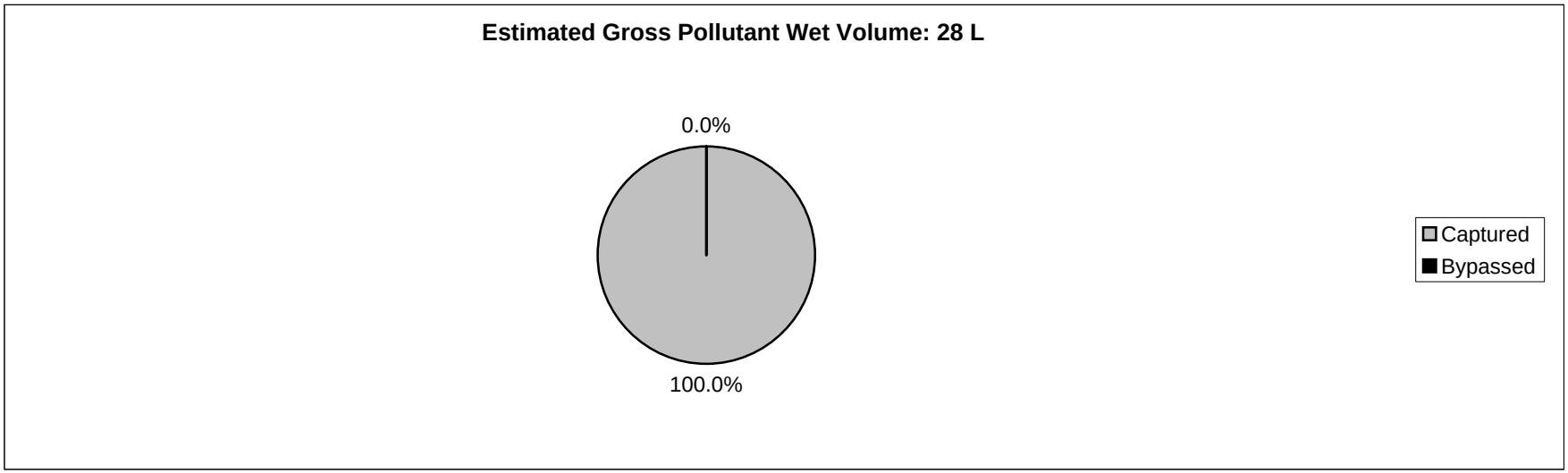


Figure 1-61

Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on November 19, 2001



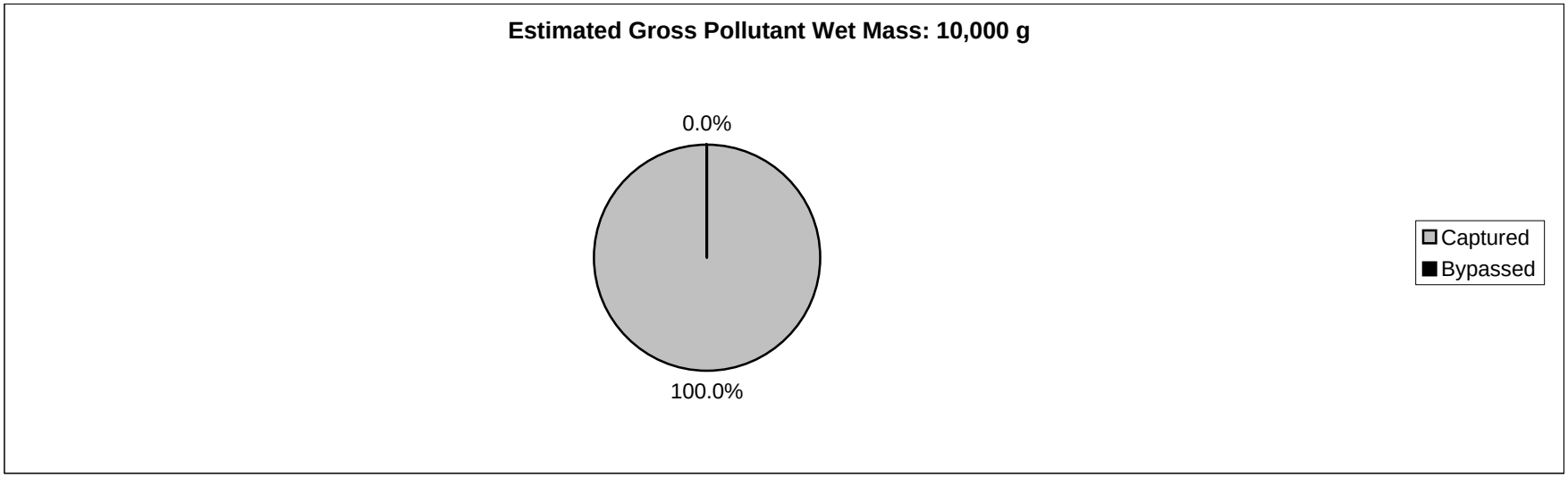
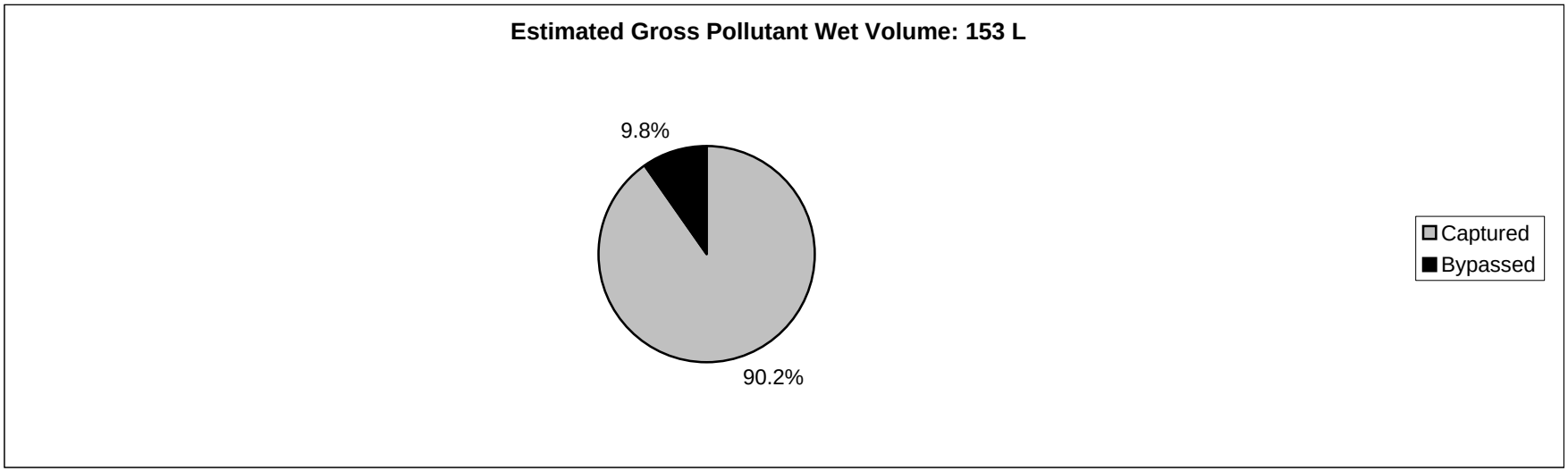


Figure 1-62

Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on November 28, 2001



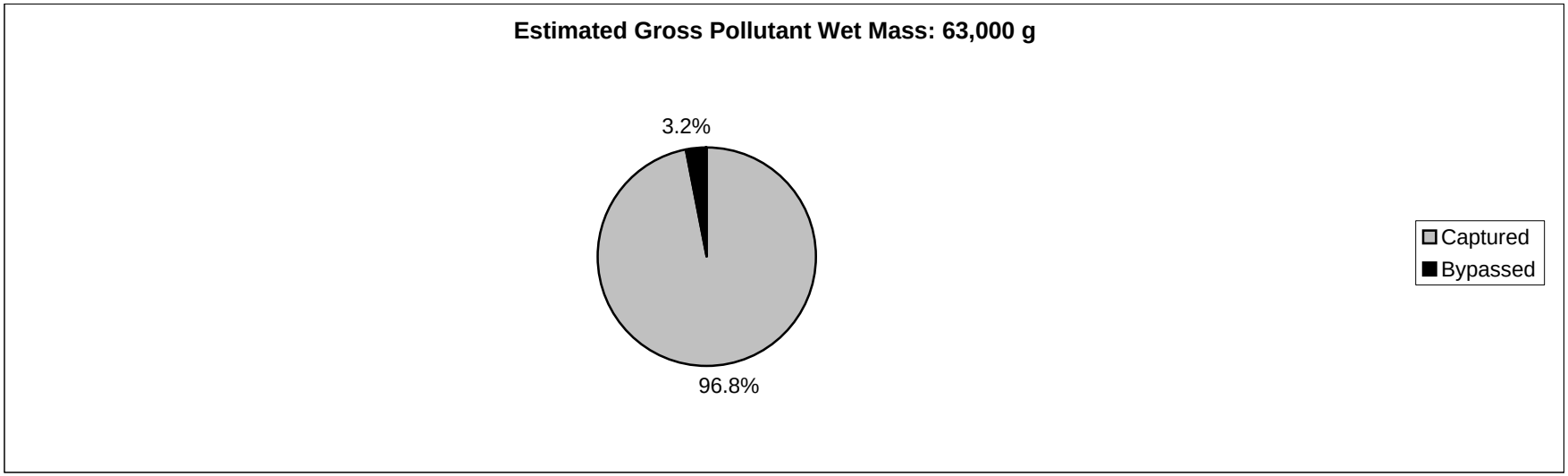
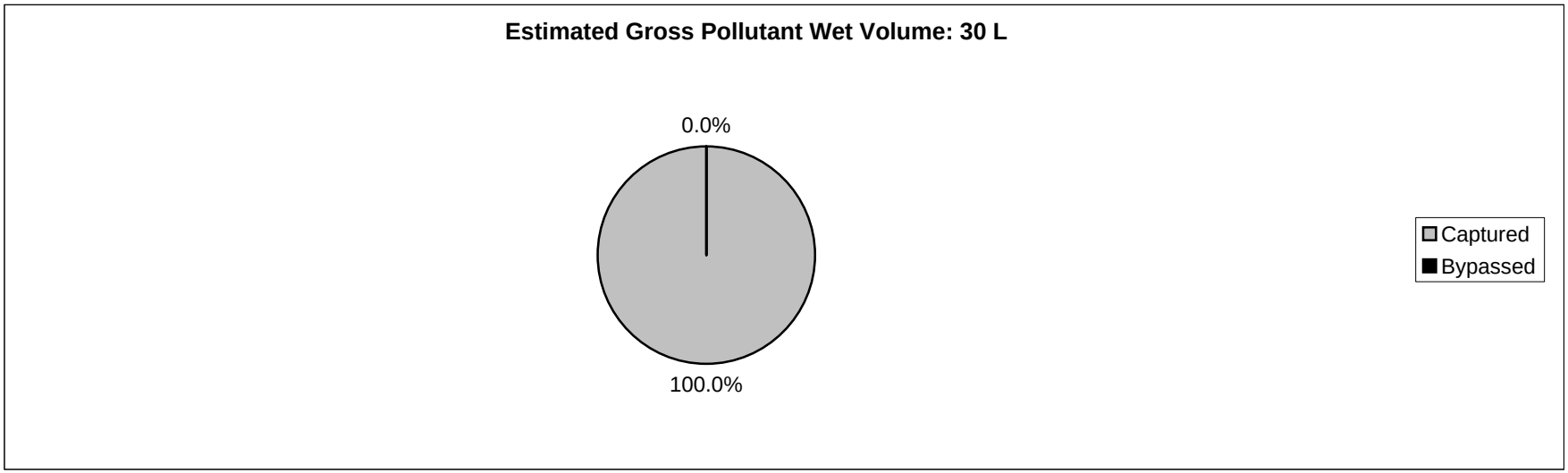


Figure 1-63

Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on January 9, 2002



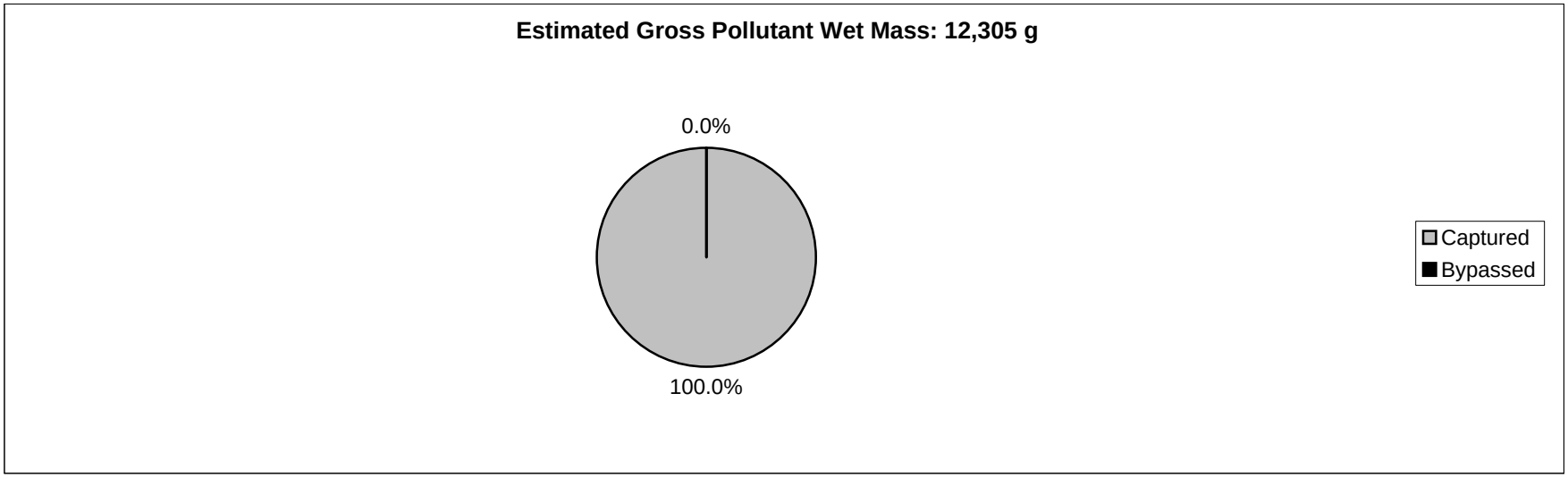
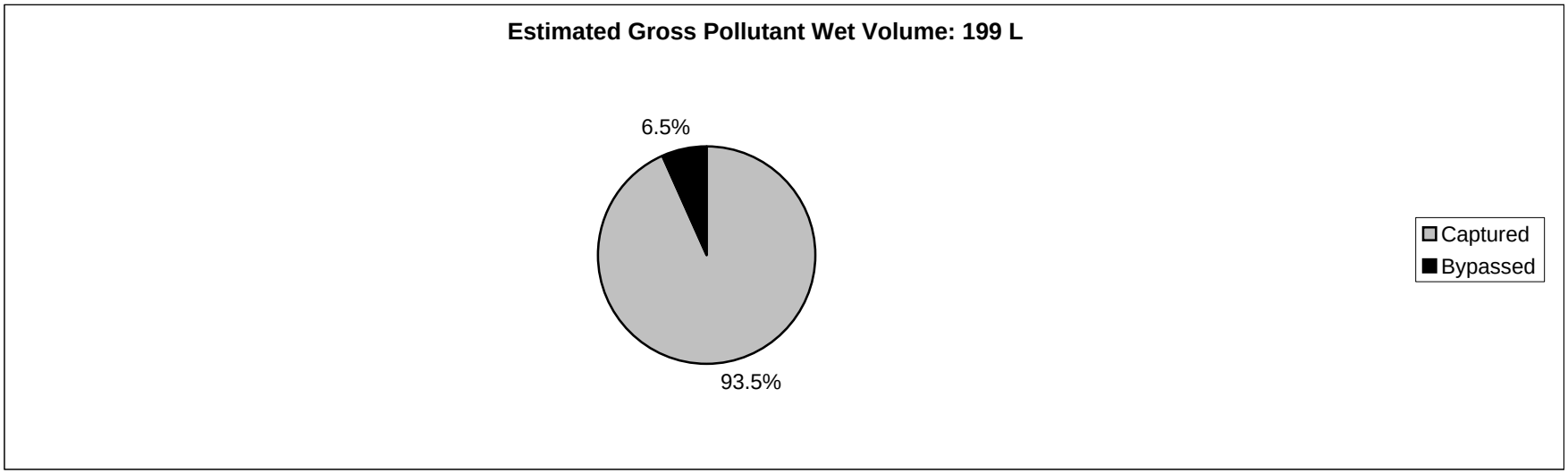


Figure 1-64

Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on January 30, 20012



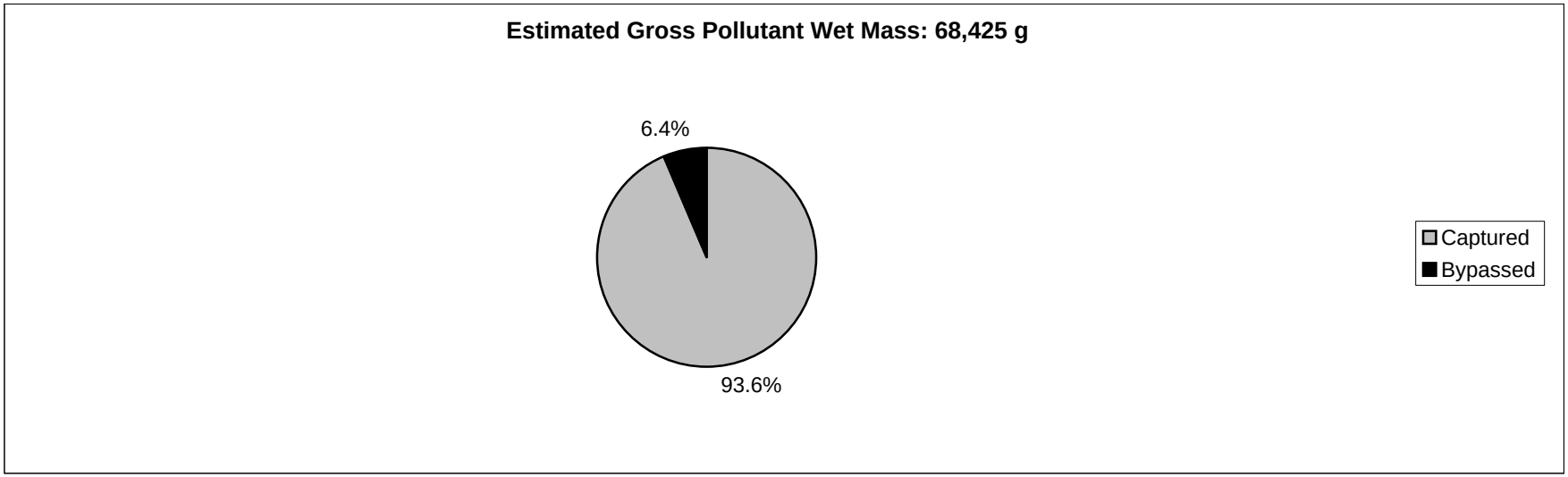
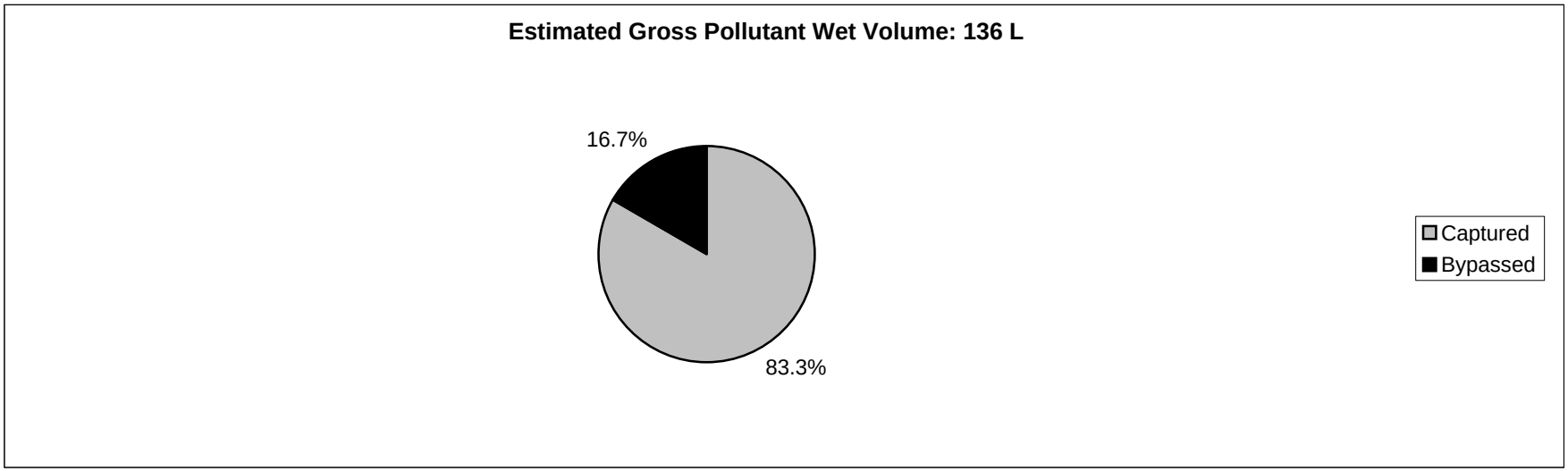


Figure 1-65

Gross Pollutant Removal Efficiency for the Cleanout of the Filmore Street CDS™ Unit on April 25, 2002



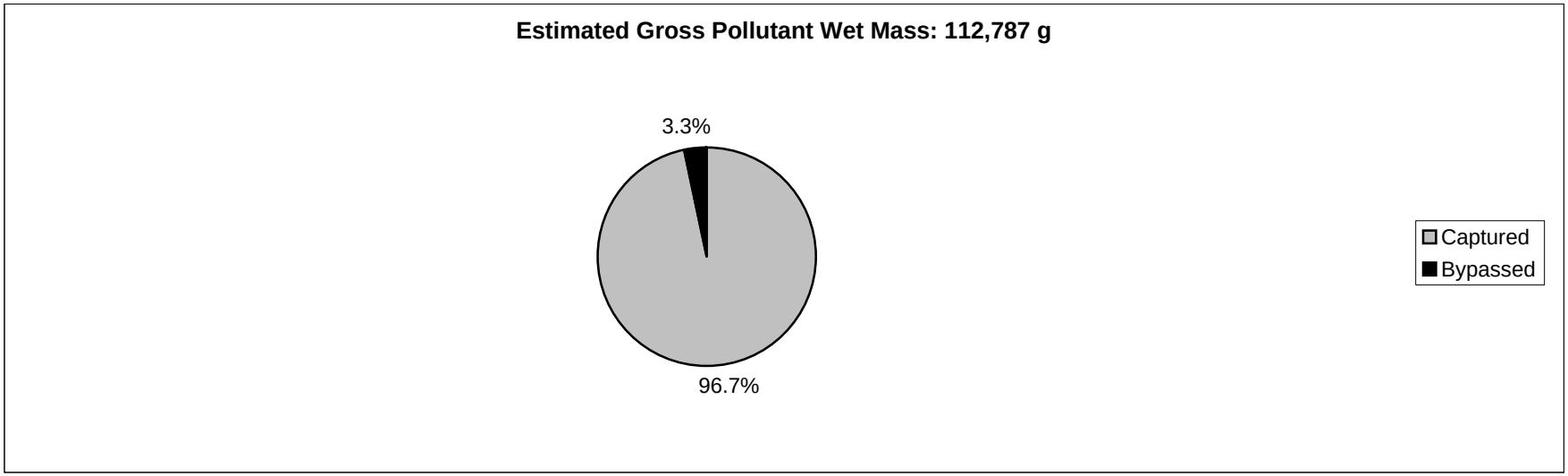
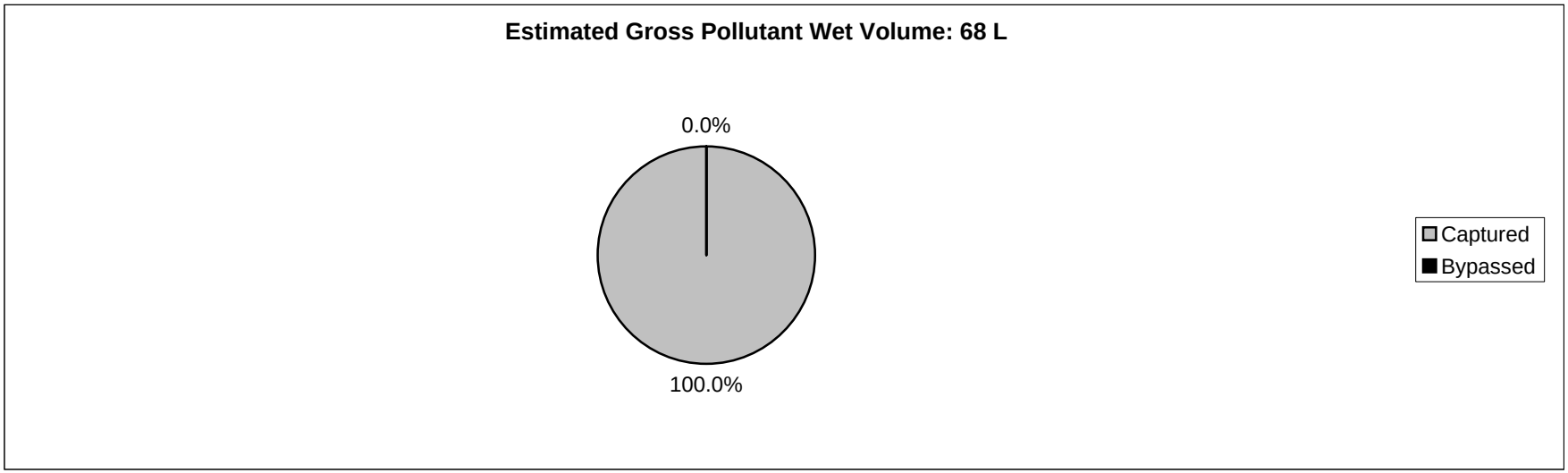


Figure 1-66

Gross Pollutant Removal Efficiency for the Cleanout of the Orcas Avenue CDS™ Unit on May 6, 2002



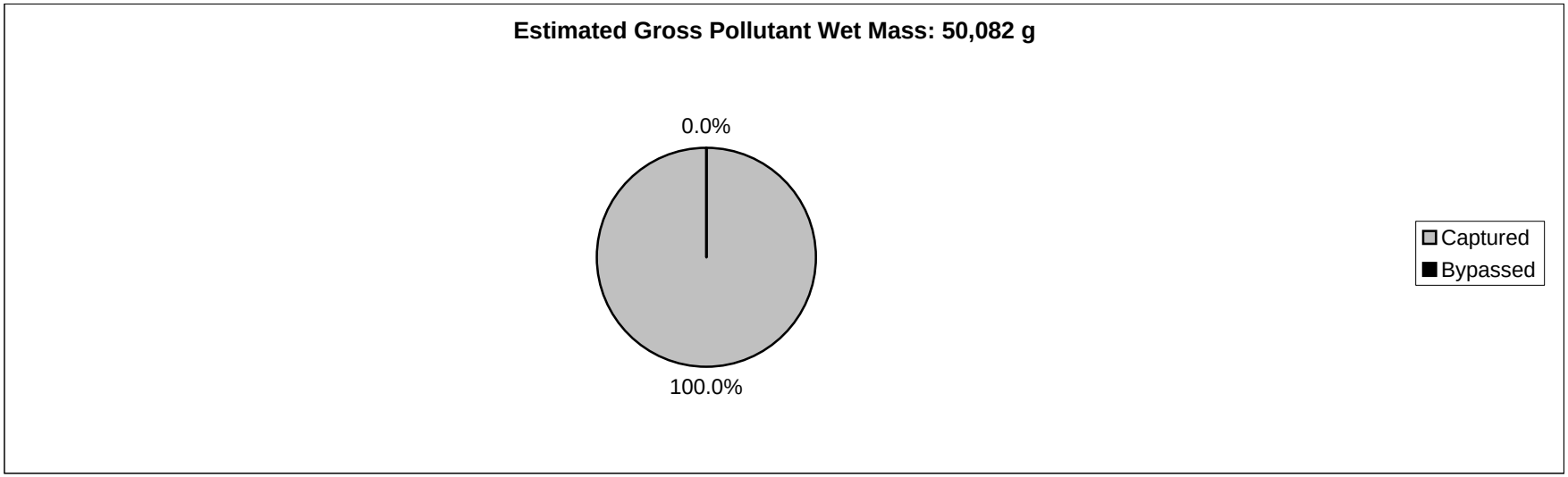


Figure 1-67
Nutrient Removal Efficiencies for the Orcas Avenue CDS™ Unit

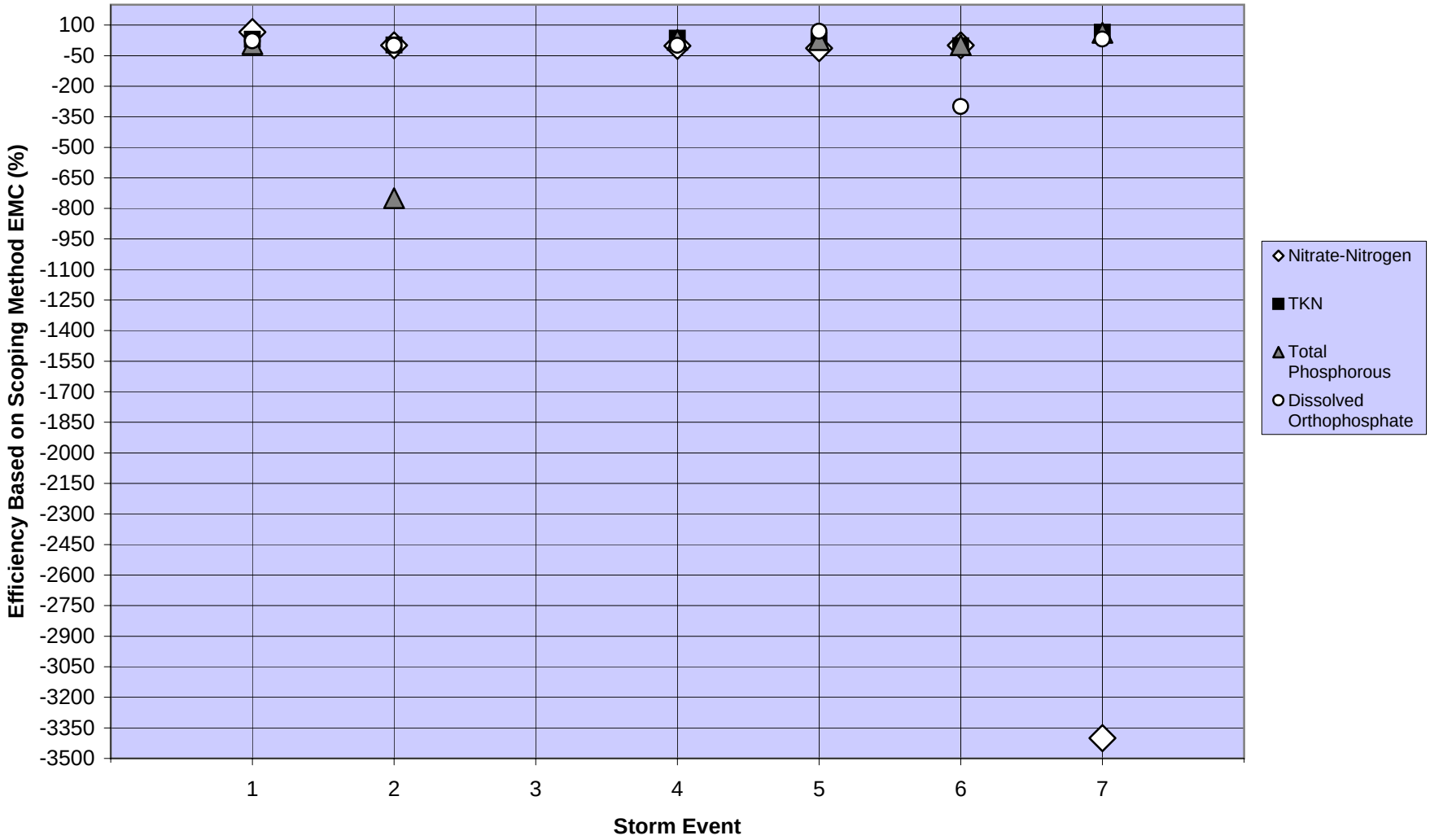


Figure 1-68
Conventional Pollutant Removal Efficiencies for the Orcas Avenue CDS™ Unit

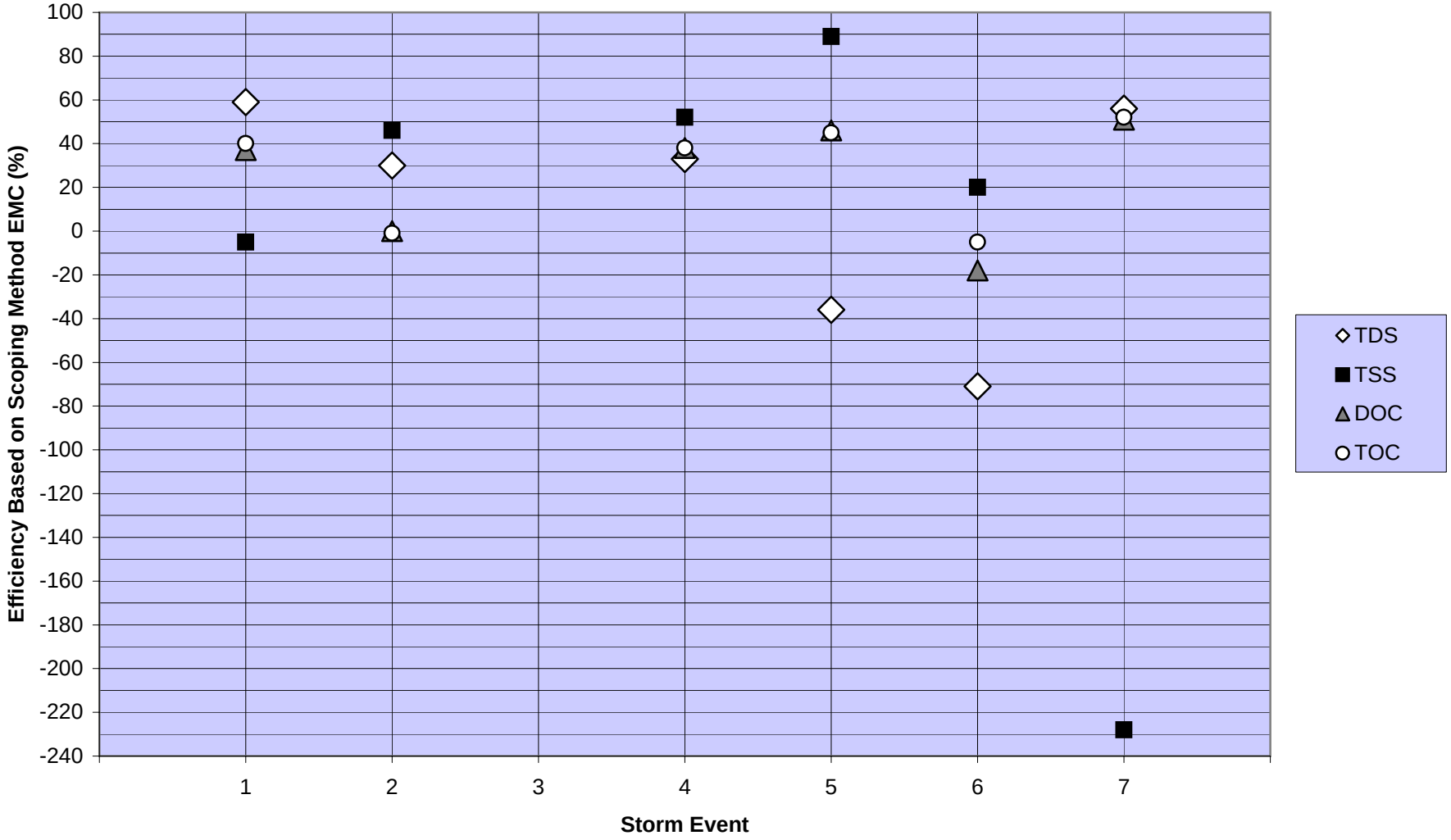


Figure 1-69
Total Metals Removal Efficiencies for the Orcas Avenue CDS™ Unit

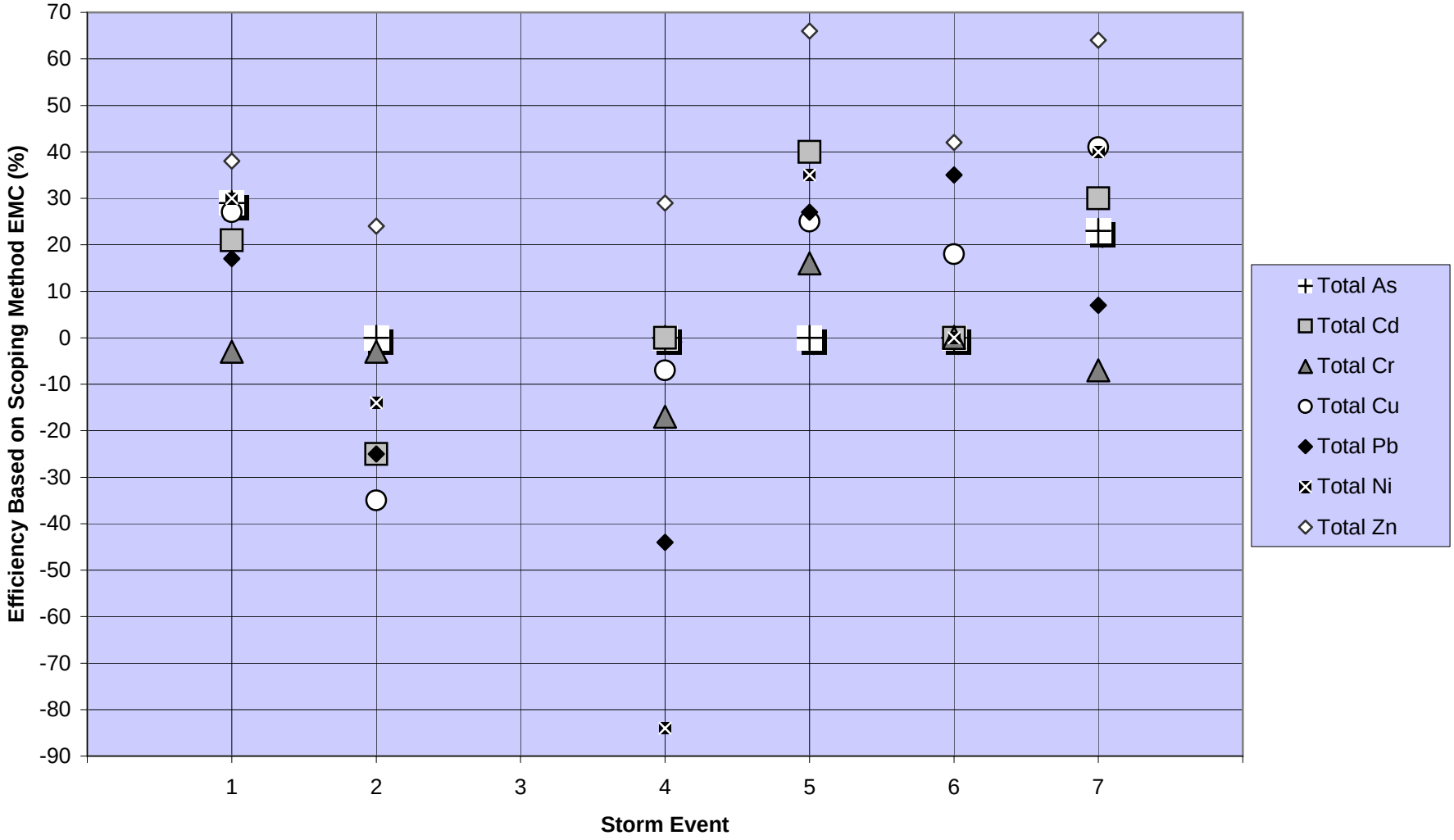


Figure 1-70
Dissolved Metals Removal Efficiencies for the Orcas Avenue CDS™ Unit

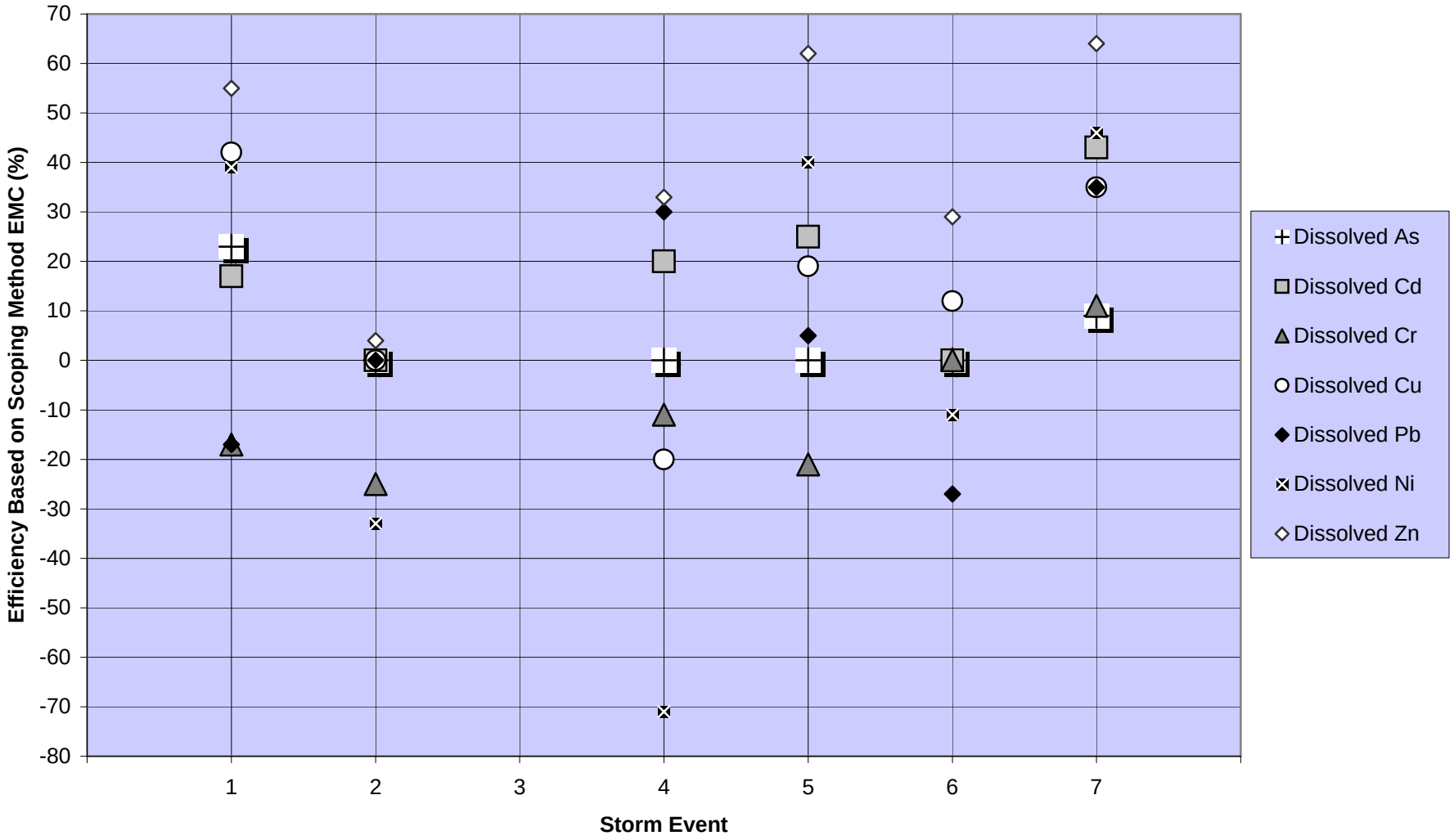


Figure 1-71
Nutrient Removal Efficiencies for the Filmore Street CDS™ Unit

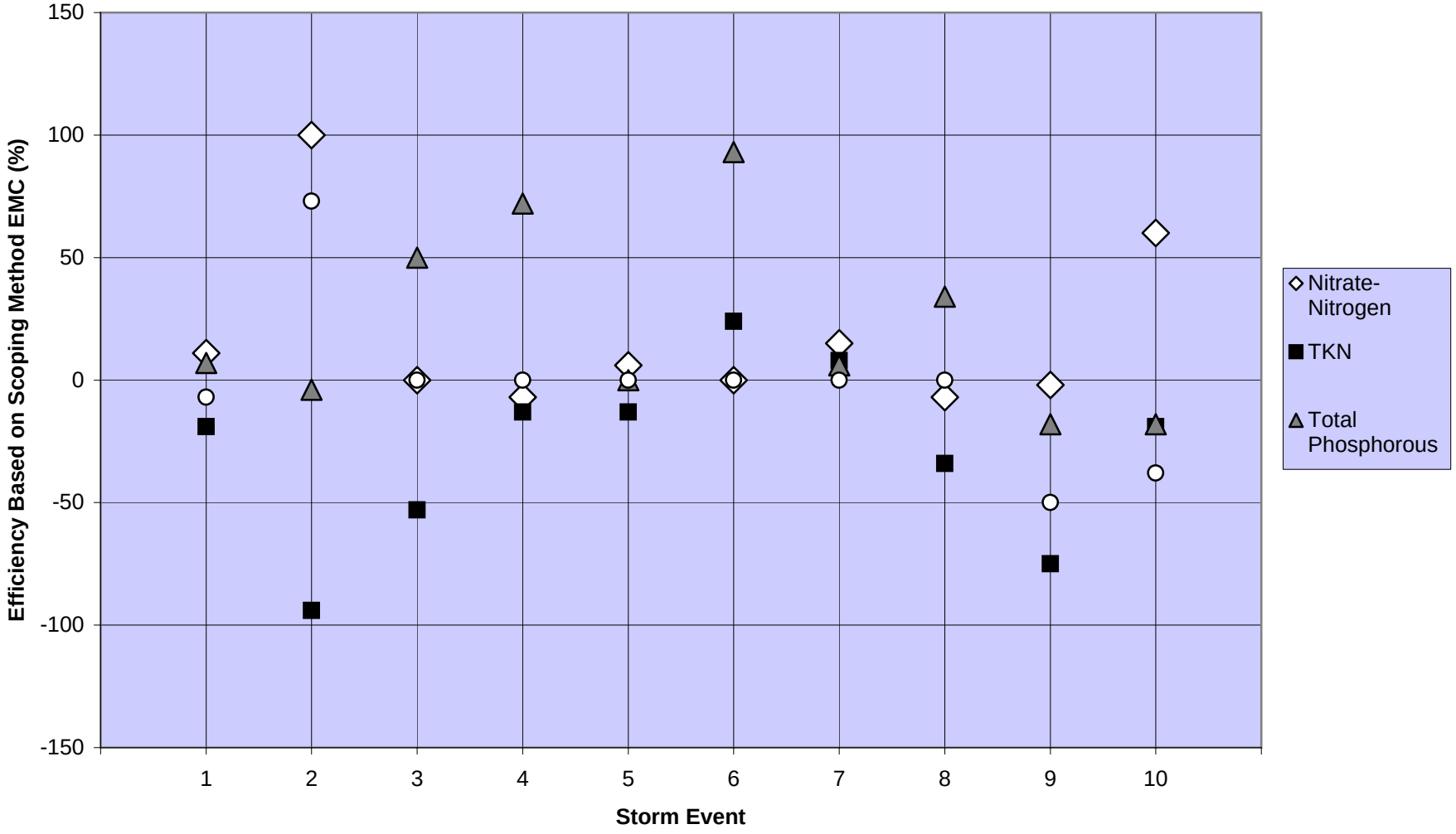


Figure 1-72
Conventional Pollutant Removal Efficiencies for the Filmore Street CDS™ Unit

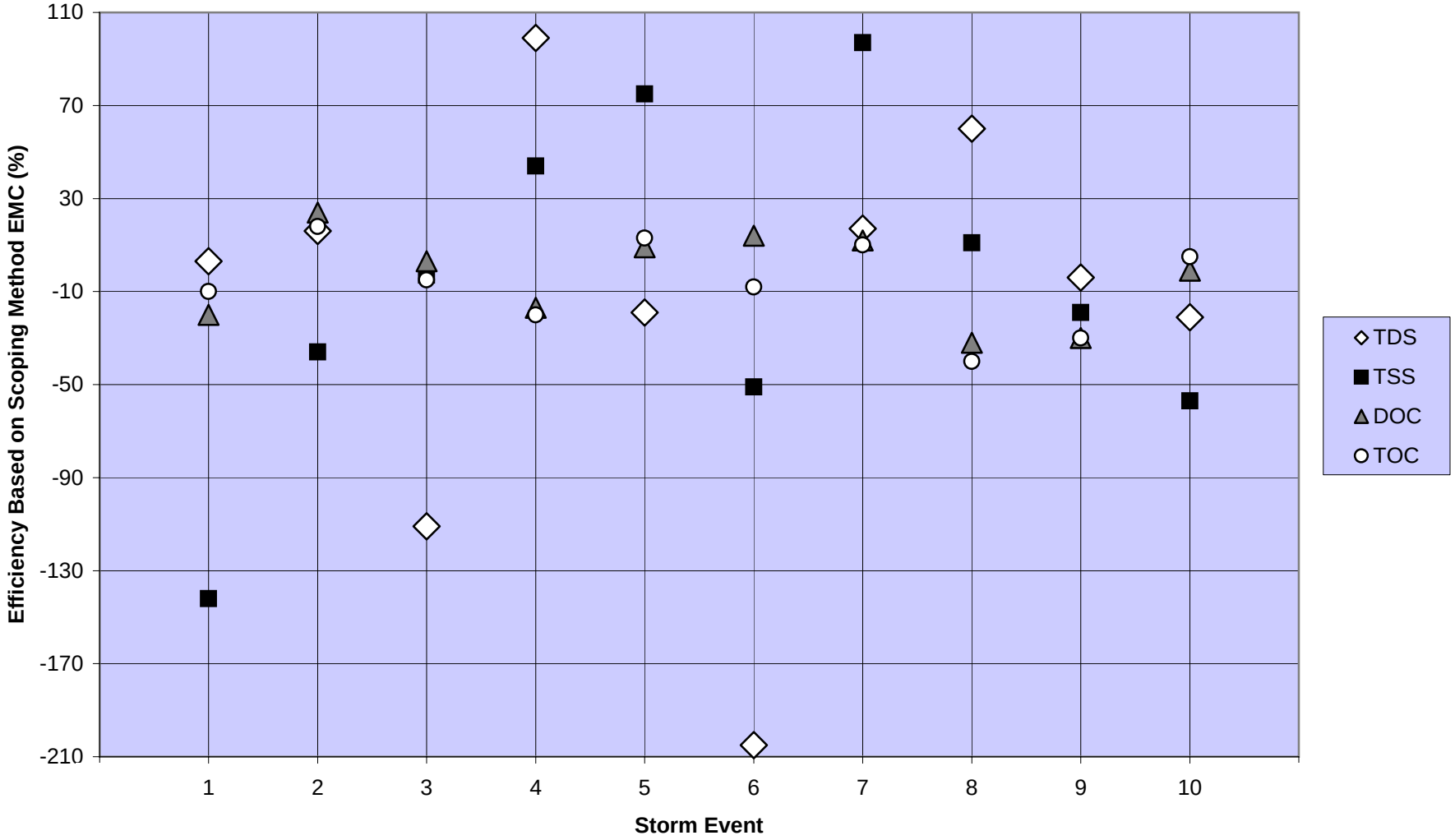


Figure 1-73
Total Metals Removal Efficiencies for the Filmore Street CDS™ Unit

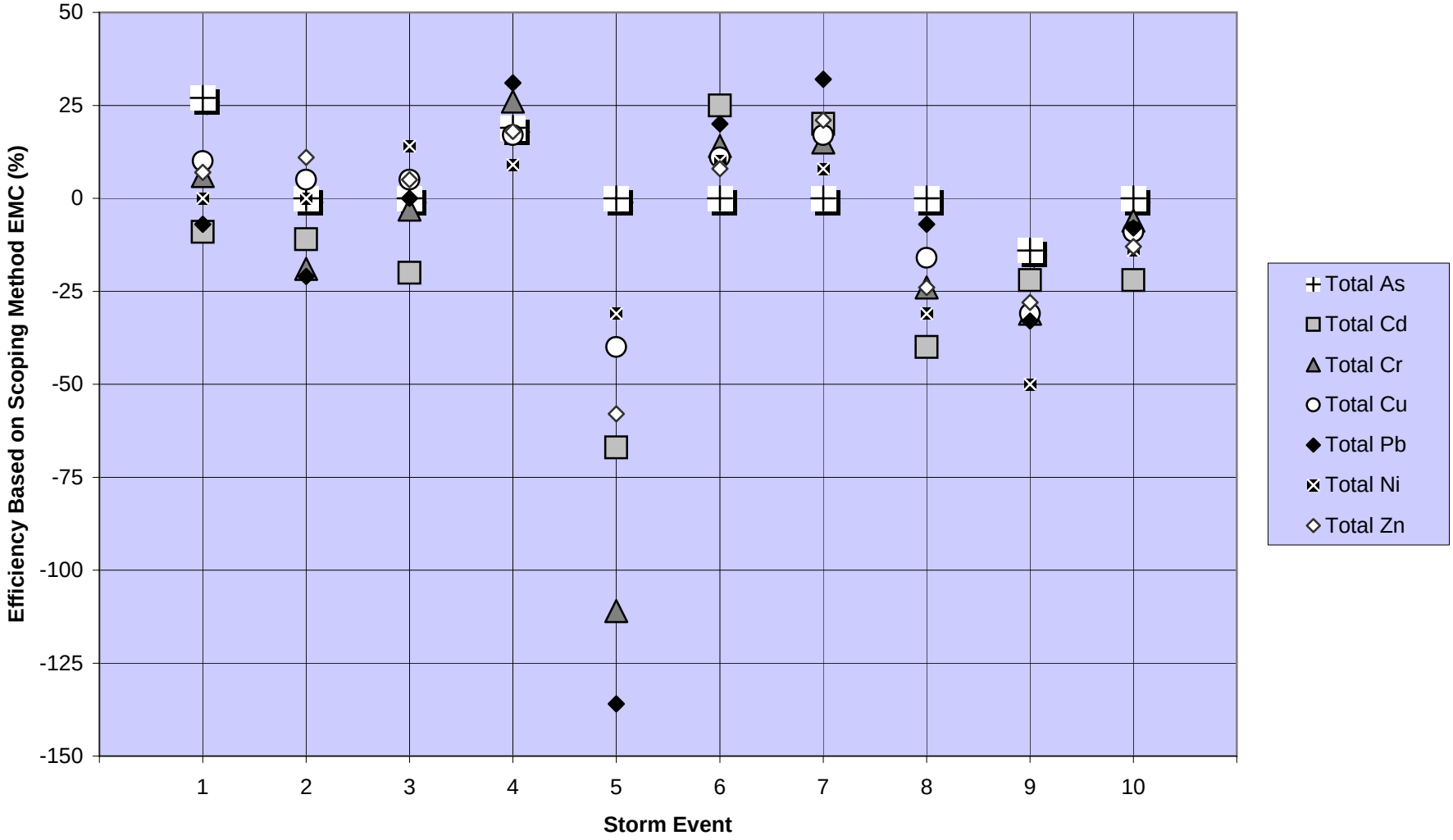


Figure 1-74
Dissolved Metals Removal Efficiencies for the Filmore Street CDS™ Unit

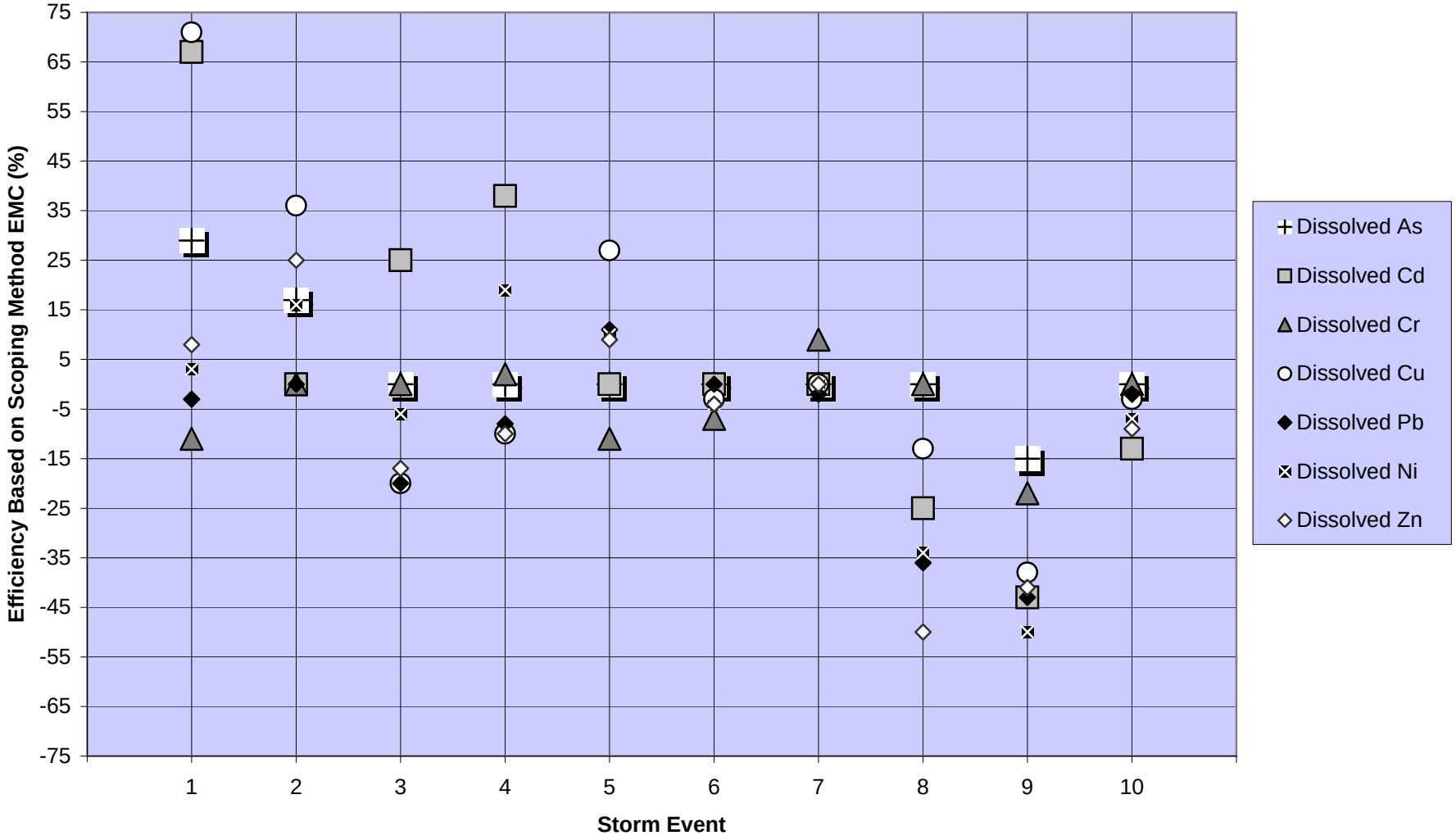


Table 1-a: Rainfall Data for the Storm Events at the CDS™ Units

Storm	Start Rain	End Rain	Rain Duration (hours)	Total Rain (mm)	Max Rainfall Intensity (mm/hr)	Antecedent Dry Days	Antecedent Event Rain (mm)	Cumulative Precipitation Prior to Event (mm)
Orcas Avenue CDS™ Unit - Effluent, 7-178								
2001-01	11/12/01 15:55	11/12/01 18:35	2.67	15.23	54.84	13	5.27	8.28
2001-02	11/24/01 13:10	11/24/01 16:00	2.58	25.36	82.32	12	15.48	23.76
2001-03	11/29/01 05:00	11/29/01 13:15	8.25	5.02	6.12	5	25.36	50.39
2001-04	12/20/01 19:35	12/21/01 00:40	5.10	10.38	15.24	6	3.77	66.46
2001-05	01/27/02 14:00	01/27/02 23:15	9.25	36.29	12.24	11	11.60	99.97
2001-06	02/17/02 04:05	02/17/02 14:00	9.90	6.78	6.12	21	36.60	137.83
2001-07	03/17/02 18:40	03/17/02 21:50	3.17	4.05	15.24	10	3.25	148.36
Filmore Street CDS™ Unit - Effluent, 7-181								
2001-01	10/30/01 13:05	10/30/01 17:05	4.00	3.51	6.12	0	0.00	0.00
2001-02	11/12/01 17:05	11/12/01 20:45	3.70	12.62	47.80	13	3.76	6.52
2001-03	11/24/01 13:00	11/24/01 15:40	2.67	24.49	40.00	12	14.46	21.48
2001-04	11/29/01 04:50	11/29/01 13:10	8.30	5.26	6.12	5	28.14	49.62
2001-05	12/02/01 21:25	12/03/01 07:35	10.16	5.54	6.12	4	5.26	54.88
2001-06	12/20/01 19:35	12/21/01 00:30	5.10	9.62	18.24	6	3.76	64.18
2001-07	01/27/02 14:00	01/27/02 22:55	10.90	27.29	12.24	11	8.80	91.62
2001-08	02/17/02 03:55	02/17/02 12:55	8.83	7.78	6.12	21	27.29	120.42
2001-09	03/06/02 17:10	03/07/02 03:20	10.17	3.25	3.00	17	6.78	127.20
2001-10	03/17/02 18:35	03/17/02 21:45	3.17	3.28	6.12	10	3.50	130.70

Table 1-b: Flow and Sample Data for the Storm Events at the CDS™ Units

Storm	Start Flow	End Flow	Flow Duration (hours)	Peak Flow (L/s)	Flow or Debris Bypass?	Total Flow (L)	Start Sample	End Sample	Sample Duration (hours)	Number of Successful Aliquots	Percent Capture	Volume to Sample (L)
Orcas Avenue CDS™ Unit - Influent, 7-177												
2001-01	11/12/01 17:20	11/12/01 19:35	2.25	64.71	Yes	45757	11/12/01 17:20	11/12/01 19:34	5.43	21	100	89
2001-02	11/24/01 13:33	11/24/01 17:14	3.68	137.42	Yes	75912	11/24/01 13:33	11/24/01 16:28	4.47	52	100	1400
2001-03	11/29/01 08:34	11/29/01 14:25	5.85	1.41	No	2515	11/29/01 08:34	11/29/01 11:31	2.95	4	95	600
2001-04	12/20/01 19:51	12/21/01 10:44	14.88	13.75	No	17366	12/20/01 19:51	12/21/01 01:04	5.22	41	98	370
2001-05	01/27/02 14:00	01/28/02 02:00	12.00	11.68	Yes	120789	01/27/02 14:00	01/28/02 00:35	10.58	86	99	500
2001-06	02/17/02 07:25	02/17/02 17:15	9.83	1.97	No	4538	02/17/02 07:25	02/17/02 12:18	4.88	14	89	290
2001-07	03/17/02 21:35	03/18/02 01:00	3.42	13.62	No	4222	03/17/02 21:35	03/18/02 00:13	2.63	52	100	80

Table 1-b: Flow and Sample Data for the Storm Events at the CDS™ Units

Storm	Start Flow	End Flow	Flow Duration (hours)	Peak Flow (L/s)	Flow or Debris Bypass?	Total Flow (L)	Start Sample	End Sample	Sample Duration (hours)	Number of Successful Aliquots	Percent Capture	Volume to Sample (L)
Orcas Avenue CDS™ Unit - Effluent, 7-178												
2001-01	11/12/01 17:20	11/12/01 19:35	2.25	64.71	Yes	45757	11/12/01 17:20	11/12/01 19:34	4.32	42	94	89
2001-02	11/24/01 13:33	11/24/01 17:14	3.68	137.42	Yes	75912	11/24/01 13:33	11/24/01 16:34	3.02	58	99	1400
2001-03	11/29/01 08:34	11/29/01 14:25	5.85	1.41	No	2515	11/29/01 08:34	11/29/01 11:37	3.05	4	96	600
2001-04	12/20/01 19:51	12/21/01 10:44	14.88	13.75	No	17366	12/20/01 19:51	12/21/01 01:07	5.27	51	98	370
2001-05	01/27/02 14:00	01/28/02 02:00	12.00	11.68	Yes	120789	01/27/02 14:00	01/27/02 18:43	11.52	37	64	500
2001-06	02/17/02 07:25	02/17/02 17:15	9.83	1.97	No	4538	02/17/02 07:25	02/17/02 12:26	5.02	14	90	290
2001-07	03/17/02 21:35	03/18/02 01:00	3.42	13.62	No	4222	03/17/02 21:35	03/17/02 23:31	4.83	23	99	80

Table 1-b: Flow and Sample Data for the Storm Events at the CDS™ Units

Storm	Start Flow	End Flow	Flow Duration (hours)	Peak Flow (L/s)	Flow or Debris Bypass?	Total Flow (L)	Start Sample	End Sample	Sample Duration (hours)	Number of Successful Aliquots	Percent Capture	Volume to Sample (L)
Filmore Street CDS™ Unit - Influent, 7-180												
2001-01	10/30/01 13:12	10/30/01 19:11	5.98	2.01	No	4159	10/30/01 13:12	10/30/01 17:28	4.27	6	96	678
2001-02	11/12/01 17:08	11/12/01 21:20	4.20	125.00	Yes	90926	11/12/01 17:08	11/12/01 21:10	4.03	70	100	268
2001-03	11/24/01 13:07	11/24/01 19:03	5.93	199.36	Yes	196892	11/24/01 13:07	11/24/01 16:55	3.80	69	100	3000
2001-04	11/29/01 04:20	11/29/01 15:07	10.78	7.41	No	18267	11/29/01 04:20	11/29/01 14:47	10.45	13	100	1400
2001-05	12/02/01 21:00	12/03/01 07:59	10.98	12.45	No	28216	12/02/01 21:32	12/03/01 06:56	9.40	14	99	2000
2001-06	12/20/01 19:36	12/21/01 03:20	7.73	48.44	Yes	65797	12/20/01 19:36	12/21/01 01:01	5.42	55	99	1200
2001-07	01/27/02 14:00	01/28/02 02:00	12.00	19.51	No	201739	01/27/02 14:00	01/27/02 20:44	6.74	100	91	2000
2001-08	02/17/02 04:05	02/17/02 15:35	11.50	11.10	No	35977	02/17/02 03:50	02/17/02 13:45	9.92	52	99	670
2001-09	03/06/02 17:10	03/07/02 04:14	11.07	1.80	No	7106	03/06/02 17:10	03/07/02 03:42	10.53	7	99	1000
2001-10	03/17/02 18:35	03/18/02 00:40	6.08	4.31	No	8552	03/17/02 18:35	03/17/02 23:30	4.92	32	96	260

Table 1-b: Flow and Sample Data for the Storm Events at the CDS™ Units

Storm	Start Flow	End Flow	Flow Duration (hours)	Peak Flow (L/s)	Flow or Debris Bypass?	Total Flow (L)	Start Sample	End Sample	Sample Duration (hours)	Number of Successful Aliquots	Percent Capture	Volume to Sample (L)
Filmore Street CDS™ Unit - Effluent, 7-181												
2001-01	10/30/01 13:12	10/30/01 19:11	5.98	2.01	No	4159	10/30/01 13:12	10/30/01 17:30	4.30	6	96	678
2001-02	11/12/01 17:08	11/12/01 21:20	4.20	125.00	Yes	90926	11/12/01 17:08	11/12/01 21:13	4.08	70	97	268
2001-03	11/24/01 13:07	11/24/01 19:03	5.93	199.36	Yes	196892	11/24/01 13:07	11/24/01 16:57	3.83	69	100	3000
2001-04	11/29/01 04:20	11/29/01 15:07	10.78	7.41	No	18267	11/29/01 04:20	11/29/01 14:51	10.52	13	100	1400
2001-05	12/02/01 21:00	12/03/01 07:59	10.98	12.45	No	28216	12/02/01 21:00	12/03/01 07:00	10.00	14	99	2000
2001-06	12/20/01 19:36	12/21/01 03:20	7.73	48.44	Yes	65797	12/20/01 19:36	12/21/01 01:06	5.50	55	99	1200
2001-07	01/27/02 14:00	01/28/02 02:00	12.00	19.51	No	201739	01/27/02 14:00	01/27/02 20:17	6.29	100	89	2000
2001-08	02/17/02 04:05	02/17/02 15:35	11.50	11.10	No	35977	02/17/02 04:05	02/17/02 13:48	9.92	51	97	670
2001-09	03/06/02 17:10	03/07/02 04:14	11.07	1.80	No	7106	03/06/02 17:10	03/07/02 03:42	10.53	7	99	1000
2001-10	03/17/02 18:35	03/18/02 00:40	6.08	4.31	No	8552	03/17/02 18:35	03/17/02 23:35	5.00	32	97	260

Table 1-c
Summary of Quality Assurance / Quality Control (QA/QC) Samples for the CDS™ Units

Site ID	Site Name	Storm Event	Sample Date	Composite Sample			TPH Grab Sample			Fecal Coliform Grab Sample		
				Field Duplicate	Laboratory Replicate	MS/MSD	Field Duplicate	Laboratory Replicate	MS/MSD	Field Duplicate	Laboratory Replicate	MS/MSD
7-177	Orcas Avenue CDS™ Unit Influent	1	November 12, 2001				X		X	X		
		2	November 24, 2001		X							
		3	November 29, 2001	No Composite Sample Taken			TPH Grab Sample Taken, No QA/QC			Fecal Coliform Grab Sample Taken, No QA/QC		
		4	December 20 -21, 2001									
		5	January 27, 2002			X						
		6	February 17, 2002	X								
		7	March 17, 2002									
7-178	Orcas Avenue CDS™ Unit Effluent	1	November 12, 2001			X						
		2	November 24, 2001	X								
		3	November 29, 2001	No Composite Sample Taken			TPH Grab Sample Taken, No QA/QC			Fecal Coliform Grab Sample Taken, No QA/QC		
		4	December 20 - 21, 2001		X		X	X	X	X	X	
		5	January 27, 2002									
		6	February 17, 2002				X	X	X	X	X	
		7	March 17, 2002									
7-180	Filmore Street CDS™ Unit Influent	1	October 30, 2001				X			X		
		2	November 12, 2001	X								
		3	November 24, 2001			X						
		4	November 29, 2001				X	X	X	X	X	
		5	December 3, 2001		X							
		6	December 20 -21, 2001									
		7	January 27, 2002		X							
		8	February 17, 2002									
		9	March 6 - 7, 2002									
		10	March 17, 2002									
7-181	Filmore Street CDS™ Unit Effluent	1	October 30, 2001				X			X		
		2	November 12, 2001									
		3	November 24, 2001				X	X	X	X	X	
		4	November 29, 2001									
		5	December 3, 2001	X								
		6	December 20 -21, 2001			X						
		7	January 27, 2002									
		8	February 17, 2002									
		9	March 6 - 7, 2002									
		10	March 17, 2002									

Table 1-d
Summary of Percent Storm Capture and the Number of Aliquots Collected During Each Storm Event

Site Name	Storm Event	Sample Date	Composite Sample Taken, Yes or No	Influent		Effluent		Comments	Figure (Hydrograph) Reference Number
				Number of Aliquots	% Storm Capture	Number of Aliquots	% Storm Capture		
Orcas Avenue CDS™ Unit	1	November 12, 2001	Yes	21	100	42	94		1-4
	2	November 24, 2001	Yes	52	100	58	99		1-5
	3	November 29, 2001	No	4	95	4	96	Composite sample discarded due to insufficient number of aliquots. Grab Samples were collected. Hydrograph created to represent storm event for the grab samples.	1-6
	4	December 20 - 21, 2001	Yes	41	98	51	98		1-7
	5	January 27, 2002	Yes	86	99	37	64	The values for total event rain total flow and the number of aliquots collected during Event 5 at the Orcas Avenue CDS™ unit are known. The timeline of this data was lost due to a flowmeter malfunction. The % storm capture values shown reflect hydrologic data collected during the storm event at the Filmore Street CDS™ Unit adjusted fit the known total event rain and total flow values from the Orcas Avenue CDS unit.	1-8
	6	February 17, 2002	Yes	14	90	14	90		1-9
	7	March 17, 2002	Yes	52	100	23	99		1-10
Filmore Street CDS™ Unit	1	October 30, 2001	Yes	6	96	6	96	Sample is from the first monitored event of the season. Sample met the minimum percent capture. Sample aliquots are well distributed and flow weighted across the hydrograph. Sample considered representative. Recommend accepting without qualification.	1-11
	2	November 12, 2001	Yes	70	100	70	97		1-12
	3	November 24, 2001	Yes	69	100	69	100		1-13
	4	November 29, 2001	Yes	13	100	13	100		1-14
	5	December 2 -3, 2001	Yes	14	99	14	99		1-15
	6	December 20 -21, 2001	Yes	55	99	55	99		1-16
	7	January 27, 2002	Yes	100	91	100	89		1-17
	8	February 17, 2002	Yes	52	99	51	97		1-18
	9	March 6 - 7, 2002	Yes	7	99	7	99	Sample met minimum percent capture. Sample results will be used as a part of a mass balance approach in calculating pollutant removal efficiencies. Sample aliquots are well distributed and flow weighted across the hydrograph. Sample considered representative. Recommend accepting without qualification.	1-19
	10	March 17, 2002	Yes	32	96	32	97		1-20

Table 1-e
Stormwater Analytical Methods and Reporting Limits for the CDS™ Units

Analyte		Symbol/ Abbreviation	Sample Type	CAS Number	Method Reference	Method Number	Reporting Limit	Units
Microbial	Fecal Coliform		Grab[1]	CT-FColi	SM	SM 9221E	2	MPN/100 mL
Organics	Total Petroleum Hydrocarbons (Diesel)	TPH (Diesel)	Grab[1]	68334-30-5	EPA	8015DRO	250	ug/L
	Total Petroleum Hydrocarbons (Gasoline)	TPH (Gasoline)	Grab[1]	8006-61-9	EPA	8015GRO	50.0	ug/L
	Total Petroleum Hydrocarbons (Heavy Oil)	TPH (Heavy Oil)	Grab[1]	CT-Hoil	EPA	8015DRO	200	ug/L
Conventionals	Dissolved Organic Carbon	DOC	Composite / Grab[1]	CT-DOC	EPA	415.1	1.0	mg/L
	Specific Conductance	EC	Composite / Grab[1]	CT-EC	EPA	120.1	1.0	umhos/cm
	Hardness as $CaCO_3$		Composite / Grab[1]	CT-Hard	EPA	130.2	2	mg/L
	Percent Hydrogen	pH	Composite / Grab[1]	CT-pH	EPA	150.1	0.1	pH Units
	Total Dissolved Solids	TDS	Composite / Grab[1]	CT-TDS	EPA	160.1	1	mg/L
	Total Organic Carbon	TOC	Composite / Grab[1]	CT-TOC	EPA	415.1	1.0	mg/L
	Total Suspended Solids	TSS	Composite / Grab[1]	CT-TSS	EPA	160.2	1	mg/L
Metals	Total & Dissolved Arsenic	As	Composite / Grab[1]	7440-38-2	EPA	200.8	1.0	ug/L
	Total & Dissolved Cadmium	Cd	Composite / Grab[1]	7440-43-9	EPA	200.8	0.2	ug/L
	Total & Dissolved Chromium	Cr	Composite / Grab[1]	7440-47-3	EPA	200.8	1.0	ug/L
	Total & Dissolved Copper	Cu	Composite / Grab[1]	7440-50-8	EPA	200.8	1.0	ug/L
	Total & Dissolved Lead	Pb	Composite / Grab[1]	7439-92-1	EPA	200.8	1.0	ug/L
	Total & Dissolved Nickel	Ni	Composite / Grab[1]	7440-02-0	EPA	200.8	2.0	ug/L
	Total & Dissolved Zinc	Zn	Composite / Grab[1]	7440-66-6	EPA	200.8	1.0	ug/L
Nutrients	Nitrate-N	NO_3-N	Composite / Grab[1]	14797-55-8	EPA	300.0	0.01	mg/L
	Total Phosphorous	P	Composite / Grab[1]	7723-14-0	EPA	365.2	0.002	mg/L
	Dissolved Ortho-Phosphate	Ortho-P	Composite / Grab[1]	CT-orthop	EPA	365.2	0.03	mg/L
	Total Kjeldahl Nitrogen	TKN	Composite / Grab[1]	CT-TKN	EPA	351.3	0.10	mg/L

[1] Grab samples taken at the CDS™ sumps were analyzed for this analyte.

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Orcas Avenue CDS™ Unit - Influent, Site 7-177												
Conventionals												
DOC	mg/L	1.0	51.4	23.4		55.1	18.8	31.6	113			
EC	umhos/cm	1.0	253	109		122	71	125	243			
Hardness as CaCO3	mg/L	2	99	27		45	2	39	44			
pH	pH Units	0.1	7.4	7.4		7.1	6.7	6.1	6.2			
TDS	mg/L	1	202	92		184	44	34	340			
TOC	mg/L	1.0	56.5	26.9		63.5	22.2	37.3	122			
TSS	mg/L	1	60	37		73	47	35	18			
Nutrients												
NO3-N	mg/L	0.01	6.95	1.33		1.06	0.50	1.18	0.01U			
Ortho-P	mg/L	0.03	0.18	0.03U		0.03U	0.10	0.03U	0.59			
P	mg/L	0.002	0.35	0.02		0.32	0.46	0.49	1.75			
TKN	mg/L	0.10	4.8	1.94		6.46	1.45	1.26	8.79			
Total Metals												
As	ug/L	1.0	1.7	1.0U		1.0U	1.0U	1.0U	1.3			
Cd	ug/L	0.2	1.4	0.4		0.5	0.5	0.7	1.0			
Cr	ug/L	1.0	6.1	3.0		1.8	2.5	1.4	2.7			
Cu	ug/L	1.0	52	17		15	20	22	37			
Ni	ug/L	2.0	12	4.4		3.8	4.0	4.6	8.5			
Pb	ug/L	1.0	29	9.6		3.6	6.4	4.8	7.6			
Zn	ug/L	1.0	320	170		140	210	310	500			
Dissolved Metals												
As	ug/L	1.0	1.3	1.0U		1.0U	1.0U	1.0U	1.1			
Cd	ug/L	0.2	0.6	0.3		0.5	0.4	0.4	0.7			
Cr	ug/L	1.0	2.3	2.4		1.8	1.4	1.0U	1.8			
Cu	ug/L	1.0	33	14		10	16	17	31			
Ni	ug/L	2.0	8.7	4.2		3.8	3.5	3.8	8.0			
Pb	ug/L	1.0	2.4	1.3		2.0	3.7	1.1	4.8			
Zn	ug/L	1.0	170	85		140	180	240	470			
Microbials												
Fecal Coliform	MPN/100 mL	2	30000	13	24000	400	400	1300	30000			
Organics												
TPH (Diesel)	ug/L	250	250U	250U	250U	250U	250U	250U	250U			
TPH (Gasoline)	ug/L	50	50U	50U	168	50U	50U	50U	50U			
TPH (Heavy oil)	ug/L	200	1200	670	1700	1200	880	660	2300			

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Orcas Avenue CDS™ Unit - Effluent, Site 7-178												
Conventionals												
DOC	mg/L	1.0	32.5	23.4		34	10.2	37.3	55.8			
EC	umhos/cm	1.0	141	94		94	48.3	126	119			
Hardness as CaCO3	mg/L	2	44	28		32	2U	39	54			
pH	pH Units	0.1	7.3	7.1		6.8	6.7	6	6.3			
TDS	mg/L	1	82	64		124	60	58	148			
TOC	mg/L	1.0	34	27.2		39.1	12.1	39.1	58.3			
TSS	mg/L	1	63	20		35	5	28	59			
Nutrients												
NO3-N	mg/L	0.01	2.39	1.33		1.08	0.57	1.17	0.35			
Ortho-P	mg/L	0.03	0.14	0.03U		0.03U	0.03	0.12	0.41			
P	mg/L	0.002	0.33	0.17		0.23	0.34	0.48	0.67			
TKN	mg/L	0.10	3.35	1.9		4.22	1.11	1.28	3.07			
Total Metals												
As	ug/L	1.0	1.2	1.0U		1.0U	1.0U	1.0U	1.0U			
Cd	ug/L	0.2	1.1	0.5		0.5	0.3	0.7	0.7			
Cr	ug/L	1.0	6.3	3.1		2.1	2.1	1.4	2.9			
Cu	ug/L	1.0	38	23		16	15	18	22			
Ni	ug/L	2.0	8.4	5.0		7.0	2.6	4.6	5.1			
Pb	ug/L	1.0	24	12		5.2	4.7	3.1	7.1			
Zn	ug/L	1.0	200	130		100	71	180	180			
Dissolved Metals												
As	ug/L	1.0	1.0U	1.0U		1.0U	1.0U	1.0U	1.0U			
Cd	ug/L	0.2	0.5	0.3		0.4	0.3	0.4	0.4			
Cr	ug/L	1.0	2.7	3.0		2.0	1.7	1.0U	1.6			
Cu	ug/L	1.0	19	14		12	13	15	20			
Ni	ug/L	2.0	5.3	5.6		6.5	2.1	4.2	4.3			
Pb	ug/L	1.0	2.8	1.3		1.4	3.5	1.4	3.1			
Zn	ug/L	1.0	76	82		94	68	170	170			
Microbials												
Fecal Coliform	MPN/100 mL	2	5000	300	24000	900	800	2300	3000			
Organics												
TPH (Diesel)	ug/L	250	250U	250U	250U	250U	250U	250U	250U			
TPH (Gasoline)	ug/L	50	50U	50U	227	50U	50U	50U	50U			
TPH (Heavy oil)	ug/L	200	1700	2100	1900	1700	840	1100	4100			

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Orcas Avenue CDS™ Unit - Effluent, Site 7-178-Sump												
Conventionals												
DOC	mg/L	1.0	68									
EC	umhos/cm	1.0	191									
Hardness as CaCO3	mg/L	2	93									
pH	pH Units	0.1	5.6									
TDS	mg/L	1	78									
TOC	mg/L	1.0	72.7									
TSS	mg/L	1	31									
Nutrients												
NO3-N	mg/L	0.01	0.04									
Ortho-P	mg/L	0.03	0.21									
P	mg/L	0.002	0.78									
TKN	mg/L	0.10	2.51									
Total Metals												
As	ug/L	1.0	1.1									
Cd	ug/L	0.2	2.0									
Cr	ug/L	1.0	7.4									
Cu	ug/L	1.0	23									
Ni	ug/L	2.0	9.8									
Pb	ug/L	1.0	12									
Zn	ug/L	1.0	290									
Dissolved Metals												
As	ug/L	1.0	1.0U									
Cd	ug/L	0.2	1.0									
Cr	ug/L	1.0	3.0									
Cu	ug/L	1.0	12									
Ni	ug/L	2.0	7.1									
Pb	ug/L	1.0	5.6									
Zn	ug/L	1.0	180									
Microbials												
Fecal Coliform	MPN/100 mL	2	220									
Organics												
TPH (Diesel)	ug/L	250	250U									
TPH (Gasoline)	ug/L	50	54.7									
TPH (Heavy oil)	ug/L	200	2400									

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Filmore Street CDS™ Unit - Influent, Site 7-180												
Conventionals												
DOC	mg/L	1.0	107	41.2	18.3	35.4	21	16.5	15.9	27	77.4	102
EC	umhos/cm	1.0	472	153	62	91	76	65	63	96	154	136
Hardness as CaCO3	mg/L	2	170	54	17	47	33	24	2	29	51	61
pH	pH Units	0.1	6.3	7.4	7.2	7.2	5.1	7.3	6.5	6.6	6.2	6.4
TDS	mg/L	1	400	102	38	112	52	38	96	94	200	188
TOC	mg/L	1.0	122	44.1	21.2	42.3	25.3	21.2	19.1	28.6	79.2	110
TSS	mg/L	1	77	55	31	100	28	39	30	27	26	23
Nutrients												
NO3-N	mg/L	0.01	11	2.82	0.80	2.0	1.62	0.79	0.85	0.97	2.66	0.10
Ortho-P	mg/L	0.03	0.40	0.11	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.12	0.13
P	mg/L	0.002	0.42	0.23	0.14	0.43	0.19	0.14	0.34	0.35	0.4	0.33
TKN	mg/L	0.10	17.7	2.02	1.09	2.55	1.7	2.52	1.48	0.74	3.4	3.99
Total Metals												
As	ug/L	1.0	3.3	1.5	1.0U	1.6	1.0U	1.0U	1.0U	1.0U	1.4	1.3
Cd	ug/L	0.2	2.2	0.9	0.5	1.3	0.3	0.4	0.5	0.5	0.9	0.9
Cr	ug/L	1.0	8.3	5.4	3.6	7.6	1.8	3.6	2.7	1.7	2.6	3.4
Cu	ug/L	1.0	83	39	20	47	15	18	18	19	32	35
Ni	ug/L	2.0	42	11	5.7	11	4.2	4.2	4.0	5.5	14	14
Pb	ug/L	1.0	15	19	11	29	5.5	11	7.5	5.9	9.0	13
Zn	ug/L	1.0	1500	380	190	330	120	130	140	210	460	470
Dissolved Metals												
As	ug/L	1.0	2.8	1.2	1.0U	1.2	1.0U	1.0U	1.0U	1.0U	1.3	1.2
Cd	ug/L	0.2	1.8	0.4	0.4	1.3	0.2	0.2	0.4	0.4	0.7	0.8
Cr	ug/L	1.0	3.7	2.2	1.8	4.4	1.8	1.5	2.3	1.1	1.8	2.6
Cu	ug/L	1.0	63	25	9.2	31	15	9.6	14	15	26	32
Ni	ug/L	2.0	36	8.7	3.6	11	4.0	2.5	3.4	4.7	12	14
Pb	ug/L	1.0	3.3	2.1	1.0	13	4.5	1.0U	4.4	1.1	6.3	8.9
Zn	ug/L	1.0	1300	240	120	210	110	72	110	160	390	460
Microbials												
Fecal Coliform	MPN/100 mL	2	50000	2200	140	5000	24000	200	900	5000	900	3000
Organics												
TPH (Diesel)	ug/L	250	250U	250U	250U	250U	250U	250U	250U	440	250U	250U
TPH (Gasoline)	ug/L	50	50U	50U	50U	50U	50U	50U	50U	50U	50U	50U
TPH (Heavy oil)	ug/L	200	8600	1100	2800	1100	2700	1300	2500	3200	3500	5800

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Filmore Street CDS™ Unit - Effluent, Site 7-181												
Conventionals												
DOC	mg/L	1.0	128	31.4	17.8	41.4	19.1	14.2	14	35.7	101	103
EC	umhos/cm	1.0	436	130	90	103	70	67	55	93	166	141
Hardness as CaCO3	mg/L	2	120	48	21	52	24	25	2U	32	52	39
pH	pH Units	0.1	6.3	7.3	7.2	7.2	6.2	7.5	6.8	6.1	6.2	6.3
TDS	mg/L	1	390	86	80	1U	62	116	80	38	208	228
TOC	mg/L	1.0	134	36	22.3	50.8	22	22.8	17.1	40	103	105
TSS	mg/L	1	186	75	32	56	7	59	1U	24	31	36
Nutrients												
NO3-N	mg/L	0.01	9.82	0.01U	0.80	2.14	1.52	0.79	0.72	1.04	2.7	0.04
Ortho-P	mg/L	0.03	0.43	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.18	0.18
P	mg/L	0.002	0.39	0.24	0.07	0.12	0.19	0.01	0.32	0.23	0.47	0.39
TKN	mg/L	0.10	21	3.91	1.67	2.88	1.92	1.91	1.36	0.99	5.95	4.73
Total Metals												
As	ug/L	1.0	2.4	1.5	1.0U	1.3	1.0U	1.0U	1.0U	1.0U	1.6	1.3
Cd	ug/L	0.2	2.4	1.0	0.6	25	0.5	0.3	0.4	0.7	1.1	1.1
Cr	ug/L	1.0	7.8	6.4	3.7	5.6	3.8	3.1	2.3	2.1	3.4	3.6
Cu	ug/L	1.0	75	37	19	39	21	16	15	22	42	38
Ni	ug/L	2.0	42	11	4.9	10	5.5	3.8	3.7	7.2	21	16
Pb	ug/L	1.0	16	23	11	20	13	8.8	5.1	6.3	12	14
Zn	ug/L	1.0	1400	340	180	270	190	120	110	260	590	530
Dissolved Metals												
As	ug/L	1.0	2.0	1.0	1.0U	1.2	1.0U	1.0U	1.0U	1.0U	1.5	1.2
Cd	ug/L	0.2	0.6	0.4	0.3	0.8	0.2	0.2	0.4	0.5	1.0	0.9
Cr	ug/L	1.0	4.1	2.2	1.8	4.3	2.0	1.6	2.1	1.1	2.2	2.6
Cu	ug/L	1.0	18	16	11	34	11	9.9	14	17	36	33
Ni	ug/L	2.0	35	7.3	3.8	8.9	3.6	2.6	3.4	6.3	18	15
Pb	ug/L	1.0	3.4	2.1	1.2	14	4.0	1.0U	4.5	1.5	9.0	9.1
Zn	ug/L	1.0	1200	180	140	230	100	75	110	240	550	500
Microbials												
Fecal Coliform	MPN/100 mL	2	90000	160000	300	8000	3000	200	400	5000	1600	50000
Organics												
TPH (Diesel)	ug/L	250	250U	250U	250U	250U	250U	250U	250U	250U	250U	250U
TPH (Gasoline)	ug/L	50	50U	50U	50U	50U	50U	50U	50U	50U	50U	50U
TPH (Heavy oil)	ug/L	200	20000	2100	2100	1800	2300	1100	2200	2100	1200	6500

Table 1-f: Stormwater Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	2001-01	2001-02	2001-03	2001-04	2001-05	2001-06	2001-07	2001-08	2001-09	2001-10
Filmore Street CDS™ Unit - Effluent, Site 7-181-Sump												
Conventionals												
DOC	mg/L	1.0	47.1									
EC	umhos/cm	1.0	184									
Hardness as CaCO3	mg/L	2	81									
pH	pH Units	0.1	6.2									
TDS	mg/L	1	88									
TOC	mg/L	1.0	49.1									
TSS	mg/L	1	23									
Nutrients												
NO3-N	mg/L	0.01	0.03									
Ortho-P	mg/L	0.03	0.07									
P	mg/L	0.002	0.57									
TKN	mg/L	0.10	2.19									
Total Metals												
As	ug/L	1.0	1.0U									
Cd	ug/L	0.2	0.3									
Cr	ug/L	1.0	2.1									
Cu	ug/L	1.0	30									
Ni	ug/L	2.0	4.4									
Pb	ug/L	1.0	4.4									
Zn	ug/L	1.0	94									
Dissolved Metals												
As	ug/L	1.0	1.0U									
Cd	ug/L	0.2	0.2									
Cr	ug/L	1.0	1.5									
Cu	ug/L	1.0	5.7									
Ni	ug/L	2.0	3.8									
Pb	ug/L	1.0	2.2									
Zn	ug/L	1.0	68									
Microbials												
Fecal Coliform	MPN/100 mL	2	110									
Organics												
TPH (Diesel)	ug/L	250	250U									
TPH (Gasoline)	ug/L	50	50U									
TPH (Heavy oil)	ug/L	200	2400									

Notes for Table 1-f

"U" Indicates that the analyte was not detected (non-detect, ND) at the associated value.
"UJ" Indicates that the parameter was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Indicates that the sample was not collected

Table 1-g

Waste Sampling Analytical Methods, Reporting Limits, and Waste Matrix (Disposal) for the CDS™ Units

Analyte		Symbol/ Abbreviation	Sample Type	Method Reference	Method Number	Reporting Limit	Units
Organics	Total Recoverable Petroleum Hydrocarbons	TRPH	Composite	EPA	418.1	10	mg/kg
	Volatile Organic Compounds	VOC	Composite	EPA	8260B	SW-846[4] Requirements	
Total Metals	California Code of Regulations (CCR) Title 22, Metals[1]		Composite	EPA	6020 / 7471	SW-846[4] Requirements	
	California Code of Regulations (CCR) Title 22, Waste Extraction Test (WET) Metals[2]		Composite	STLC[2]	Extraction Procedure	SW-846[4] Requirements	
	Toxicity Characteristics Leaching Procedure (TCLP) Metals[3]		Composite	TCLP[3] Procedure	1311	SW-846[4] Requirements	

[1] California Code of Regulations (CCR) Title 22 Metals [Sb, As, Ba, Be, Cd, Cr (Total), Co, Cu, Hg, Pb, Mo, Ni, Se, Ag, Tl, V, Zn]. Initial waste characterization results may lead to a shorter list of metals for subseqent metal disposal.

[2] Any sample for total metals that are below the Total Threshold Limit Concentration (TTLC) but exceed the ten times Soluble Threshold Limit Concentration (STLC) will be further analyzed using the Waste Extraction Test (WET) procedure. WET extracts will be analyzed only for metals which exceed the ten time STLC criteria. Sediments associated with total metal results excced the TTLC values are automatically considered hazardous and therefore do not need to undergo the WET procedure.

[3] If any of the WET-soluble concentrations are equal to or greater than the Toxicity Characteristic Leaching Procedure (TCLP) regulatory thresholds, then analysis of the waste by TCLP may be required.

[4] "Test Methods for Evaluating Solid Waste, Physical / Chemical Methods". SW-846, Update III (SW-846)

Table 1-h: Waste Sampling Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	Final Cleanout Orcas Ave-Sump	Final Cleanout Filmore St-Sump
Conventionals				
DOC	mg/L	1.0	266	403
EC	umhos/cm	1.0	582	692
Hardness as CaCO3	mg/L	2	282	171
pH	pH Units	0.1	5.9	6
SSC	mg/L	1	85	2314
TDS	mg/L	1	392	760
TOC	mg/L	1.0	287	691
TSS	mg/L	1	81	1751
Nutrients				
NO3-N	mg/L	0.01	0.01UJ	0.01UJ
Ortho-P	mg/L	0.03	0.03UJ	0.03UJ
P	mg/L	0.002	3.15	2.76
TKN	mg/L	0.10	9.9	8.84
Total Metals				
Ag	ug/L	0.2	0.2U	0.3
As	ug/L	1.0	1.6	2.9
Be	ug/L	0.2	0.2U	0.2
Cd	ug/L	0.2	1.5	2.8
Co	ug/L	1	3.2	4.6
Cr	ug/L	1.0	4.8	8.1
Cu	ug/L	1.0	17	64
Hg	ng/L	50	0.47	0.2U
Mo	ug/L	1	2.4	9.8
Ni	ug/L	2.0	10	53
Pb	ug/L	1.0	9.0	14
Sb	ug/L	1	3.3	3.9
Se	ug/L	2	2U	2U
Tl	ug/L	1	1U	1U
V	ug/L	1	1U	10
Zn	ug/L	1.0	710	890
Dissolved Metals				
As	ug/L	1.0	1.0U	1.3
Cd	ug/L	0.2	0.2U	0.5
Cr	ug/L	1.0	1.6	5.2
Cu	ug/L	1.0	1.2	13
Ni	ug/L	2.0	9.4	37
Pb	ug/L	1.0	1.0U	2.2
Zn	ug/L	1.0	48	140
Organics				
MTBE	mg/L	0.0005	0.0005U	0.0005U
TPH (Diesel)	ug/L	250	250U	250U

Table 1-h: Waste Sampling Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	Final Cleanout Orcas Ave-Sump	Final Cleanout Filmore St-Sump
Organics				
TPH (Gasoline)	ug/L	50	96.8	159
TPH (Heavy oil)	ug/L	200	820	32000
Semi-volatile Organic Compounds				
1,2,4-Trichlorobenzene	ug/L	0.5	0.5U	0.5U
Hexachlorobutadiene	ug/L	0.5	0.5U	0.5U
Naphthalene	ug/L	0.5	0.5U	0.5U
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	ug/L	0.5	0.5U	0.5U
1,1,1-Trichloroethane	ug/L	0.5	0.5U	0.5U
1,1,2,2-Tetrachloroethane	ug/L	0.5	0.5U	0.5U
1,1,2-Trichloroethane	ug/L	0.5	0.5U	0.5U
1,1-Dichloroethane	ug/L	0.5	0.5U	0.5U
1,1-Dichloroethylene	ug/L	0.5	0.5U	0.5U
1,1-dichloropropene	ug/L	0.5	0.5U	0.5U
1,2,3-trichlorobenzene	ug/L	0.5	0.5U	0.5U
1,2,3-trichloropropane	ug/L	0.5	0.5U	0.5U
1,2,4-trimethylbenzene	ug/L	0.5	0.5U	0.5U
1,2-Dibromo-3-chloropropane	ug/L	0.5	0.5U	0.5U
1,2-Dibromoethane	ug/L	0.5	0.5U	0.5U
1,2-Dichlorobenzene	ug/L	0.5	0.5U	0.5U
1,2-Dichloroethane	ug/L	0.5	0.5U	0.5U
1,2-Dichloropropane	ug/L	0.5	0.5U	0.5U
1,2-Trans-Dichloroethylene	ug/L	0.5	0.5U	0.5U
1,3,5-trimethylbenzene	ug/L	0.5	0.5U	0.5U
1,3-Dichlorobenzene	ug/L	0.5	0.5U	0.5U
1,3-dichloropropane	ug/L	0.5	0.5U	0.5U
1,4-Dichlorobenzene	ug/L	0.5	0.5U	0.5U
2,2-dichloropropane	ug/L	0.5	0.5U	0.5U
2-chlorotoluene	ug/L	0.5	0.5U	0.5U
4-chlorotoluene	ug/L	0.5	0.5U	0.5U
Benzene	ug/L	0.5	0.5U	0.5U
Bromobenzene	ug/L	0.5	0.5U	0.5U
Bromoform	ug/L	0.5	0.5U	0.5U
Carbon Tetrachloride	ug/L	0.5	0.5U	0.5U
Chlorobenzene	ug/L	0.5	0.5U	0.5U
Chlorodibromomethane	ug/L	0.5	0.5U	0.5U
Chloroethane	ug/L	0.5	0.5U	0.5U
Chloroform	ug/L	0.5	0.5U	0.5U
cis-1,2-Dichloroethene	ug/L	0.5	0.5U	0.5U
cis-1,3-Dichloropropene	ug/L	0.5	0.5U	0.5U
Dibromomethane	ug/L	0.5	0.5U	0.5U

Table 1-h: Waste Sampling Analytical Data for the CDS™ Units

Parameter	Units	Reporting Limit	Final Cleanout Orcas Ave-Sump	Final Cleanout Filmore St-Sump
Volatile Organic Compounds				
Dichlorobromomethane	ug/L	0.5	0.5U	0.5U
Dichlorodifluoromethane	ug/L	0.5	0.5U	0.5U
di-isopropyl ether	ug/L	0.5	0.5U	0.5U
Ethyl tert-butyl ether	ug/L	0.5	0.5U	0.5U
Ethylbenzene	ug/L	0.5	3.4	2.9
Isopropylbenzene	ug/L	0.5	0.5U	0.5U
Methyl Bromide	ug/L	0.5	0.5U	0.5U
Methyl Chloride	ug/L	0.5	0.5U	0.5U
Methylene Chloride	ug/L	0.5	0.5U	0.5U
n-butylbenzene	ug/L	0.5	0.5U	0.5U
n-propylbenzene	ug/L	0.5	0.5U	0.5U
o-Xylene	ug/L	0.5	2.1	6.7
p-isopropyltoluene	ug/L	0.5	8.2	5
sec-butylbenzene	ug/L	0.5	0.5U	0.5U
Styrene	ug/L	0.5	1.2	0.5U
tert-amyl ether	ug/L	0.5	0.5U	0.5U
tert-butyl alcohol	ug/L	0.5	0.5U	0.5U
tert-butylbenzene	ug/L	0.5	0.5U	0.5U
Tetrachloroethylene (PCE)	ug/L	0.5	0.5U	0.5U
Toluene	ug/L	0.5	391	431J
trans-1,3-Dichloropropene	ug/L	0.5	0.5U	0.5U
Trichloroethylene (TCE)	ug/L	0.5	0.5U	0.5U
Trichlorofluoromethane	ug/L	0.5	0.5U	0.5U
Vinyl Chloride	ug/L	0.5	0.5U	0.5U
Xylenes (total)	ug/L	0.5	1.7	6.1

Notes for Table 1-h

"U" Indicates that the analyte was not detected (non-detect, ND) at the associated value.
"UJ" Indicates that the parameter was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
"J" Indicates an estmated value.

Table 1-i
Incineration Summary

SAMPLE	PARAMETER	VALUE	UNITS
Filmore Street CDS™ Unit Floatables Subsample	Pre-burned Subsample =	343	g
	Post-burned Subsample =	89	g
	Loss (organic) =	254	g
	Left (inorganic) =	89	g
	% organic	74	%
	% inorganic[1]	26	%
Filmore Street CDS™ Unit Annular Space Sample	Pre-burned Subsample =	465	g
	Post-burned Subsample =	379	g
	Loss (organic) =	86	g
	Left (inorganic) =	379	g
	% organic	18	%
	% inorganic	82	%
Orcas Avenue CDS™ Unit Basket Load (Settlables + Sump Sediment)	Pre-burned load	9076	g
	Post-burned load	4253	g
	Loss (organic) =	4823	g
	Left (inorganic) =	4253	g
	% organic	53	%
	% inorganic[1]	47	%
Filmore Street CDS™ Unit Basket Load (Settleables + Sump Sediment)	**Subsample 1**		
	Pre-burned load	670	g
	Post-burned load	202	g
	Loss (organic) =	468	g
	Left (inorganic) =	202	g
	% organic	70	%
	% inorganic	30	%
	Subsample 2		
	Pre-burned load	1403	g
	Post-burned load	650	g
	Loss (organic) =	753	g
	Left (inorganic) =	650	g
	% organic	54	%
	% inorganic	46	%
	Subsample 3		
	Pre-burned load	1523	g
	Post-burned load	920	g
	Loss (organic) =	603	g
	Left (inorganic) =	920	g
	% organic	40	%
	% inorganic	60	%
	Subsample Total		
	Pre-burned load	3596	g
	Post-burned load	1772	g
	Loss (organic) =	1824	g
	Left (inorganic) =	1772	g
	% organic	51	%
	% inorganic[1]	49	%

[1] The conversion factor used to convert total dry mass into inorganic-only mass.

Column Heading Definitions

Sample = Description of the Sample incinerated.

Parameter = Description of the type of measurement listed. The pre-burned and post-burned loads were measurements collected before and after incineration, respectively. The loss of organic material is the amount of organic material burned off during incineration and was calculated by subtracting the post from the pre-burned load. The amount of inorganic material left is assumed to be the post-burned load.

Value = Measured or calculated value for each parameter above.

Units = Units of each value above.

Table 1-j
Captured Non-Volatile Solids Summary

Orcas Avenue CDS™ Unit Captured Sediment (Inorganic) Summary

	Orcas Avenue CDS™ Unit Cleanout Date											
	11/19/01		11/28/02		01/09/02		01/30/02		05/06/02			
Measurement	Settleables	Floatables	Settleables	Floatables	Settleables	Floatables	Settleables	Floatables	Sump Water	Settleables + Sump Sediment	Floatables	**TOTAL**
Dry mass (g)	X	730	1651	495	X	244	1411	11	N/A	9076	1063	**14,681**
Conversion factor	X	0.26	0.47	0.26	X	0.26	0.47	0.26	N/A	0.47	0.26	
Inorganic mass (g)	X	189.8	775.97	128.70	X	63.44	663.17	2.86	N/A	4265.72	276.38	**6,366**
Inorganic mass (lbs)	X	0.42	1.71	0.28	X	0.14	1.46	0.01	0.14	9.38	0.61	**14**

Filmore Street CDS™ Unit Captured Sediment (Inorganic) Summary

	Filmore Street CDS™ Unit Cleanout Date			
	4/25/2002			
Measurement	Sump Water	Settleables + Sump Sediment	Floatables	**TOTAL**
Dry mass (g)	N/A	63,432	315	**63,747**
Conversion factor	N/A	0.49	0.26	
Inorganic mass (g)	N/A	31,081.68	81.90	**31,164**
Inorganic mass (lbs)	2.94	68.38	0.18	**72**

X: The depth threshold for maintenance was not met, consequently no pollutants were removed and quantified during the cleanout.

N/A: Not Applicable

Column Heading Definitions

Measurement = The types of measurements listed include the total dry mass and inorganic mass (in both grams and pounds). A conversion factor used to convert the total dry mass into an inorganic-only mass (See Table 1-i).

CDS™ Cleanout Date =Dates that the Orcas Avenue and Filmore Street CDS™ units were cleaned out. For each cleanout, material was segregated at the site into settleables, floatables, and bypass loads. Bypass loads are not listed because they are not included in the mass-balance removal efficiency calculations.

Total = The total calculated dry mass and inorganic mass for all cleanouts at each site.

Row Heading Definitions

Total dry mass = Dry mass of the settleables and floatables loads, as measured prior to incineration at LAW's San Diego office.

Conversion Factor = Factor used to convert the total dry mass of the settleables or floatables load to a dry mass of inorganic material only. This factor, calculated in Table 1-i, was based on the dry mass of material prior to incineration and the dry mass of material after burning off the organic material for the Orcas Avenue 4/25/02 and Filmore Street 5/6/02 cleanouts. The conversion factor for the Orcas Avenue and Filmore Street floatables loads was based on the incineration results for the Filmore Street floatables subsample. The conversion factors for the Orcas Avenue and Filmore Street settleables load were based on the incineration results for the Orcas Avenue and Filmore Street basket loads, respectively.

Inorganic mass (g) = The mass of the settleables and floatables loads after applying the conversion factor from above to the total dry mass.

Table 1-k

Water Quality Pollutant Removal Efficiencies for the Orcas Avenue CDS™ Unit

Scoping Study Methodology

	11/12/2001				11/24/2001				12/20/2001			
	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff. in	EMCs		Efficiency	% Diff.
	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	Load	Influent	Effluent	(%)	in Load
TDS (mg/L)	202	82	59	59	92	64	30	30	184	124	33	33
TSS (mg/L)	60	63	-5	-5	37	20	46	46	73	35	52	52
DOC (mg/L)	51.4	32.5	37	37	23.4	23.4	0	0	55.1	34	38	38
TOC (mg/L)	56.5	34	40	40	26.9	27.2	-1	-1	63.5	39.1	38	38
Total As (ug/L)	1.7	1.2	29	29	1.0	1.0	0	0	1.0	1.0	0	0
Total Cd (ug/L)	1.4	1.1	21	21	0.4	0.5	-25	-25	0.5	0.5	0	0
Total Cr (ug/L)	6.1	6.3	-3	-3	3.0	3.1	-3	-3	1.8	2.1	-17	-17
Total Cu (ug/L)	52	38	27	27	17	23	-35	-35	15	16	-7	-7
Total Pb (ug/L)	29	24	17	17	9.6	12.0	-25	-25	3.6	5.2	-44	-44
Total Ni (ug/L)	12	8.4	30	30	4.4	5	-14	-14	3.8	7.0	-84	-84
Total Zn (ug/L)	320	200	38	38	170	130	24	24	140	100	29	29
Dissolved As (ug/L)	1.3	1.0	23	23	1.0	1.0	0	0	1.0	1.0	0	0
Dissolved Cd (ug/L)	0.6	0.5	17	17	0.3	0.3	0	0	0.5	0.4	20	20
Dissolved Cr (ug/L)	2.3	2.7	-17	-17	2.4	3.0	-25	-25	1.8	2.0	-11	-11
Dissolved Cu (ug/L)	33	19	42	42	14	14	0	0	10	12	-20	-20
Dissolved Pb (ug/L)	2.4	2.8	-17	-17	1.3	1.3	0	0	2.0	1.4	30	30
Dissolved Ni (ug/L)	8.7	5.3	39	39	4.2	5.6	-33	-33	3.8	6.5	-71	-71
Dissolved Zn (ug/L)	170	76	55	55	85	82	4	4	140	94	33	33
Nitrate-Nitrogen (mg/L)	6.95	2.39	66	66	1.33	1.33	0	0	1.06	1.08	-2	-2
TKN (mg/L)	4.80	3.35	30	30	1.94	1.9	2	2	6.46	4.22	35	35
Total P (mg/L)	0.35	0.33	6	6	0.02	0.17	-750	-750	0.32	0.23	28	28
Diss. Ortho-Phosphate (mg/L)	0.18	0.14	22	22	0.03	0.03	0	0	0.03	0.03	0	0
Storm Volume (liters)	45759	45759			75912	75912			17366	17366		

	1/27/2002				2/17/2002				3/17/2002			
	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff. in	EMCs		Efficiency	% Diff.
	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	Load	Influent	Effluent	(%)	in Load
TDS (mg/L)	44	60	-36	-36	34	58	-71	-71	340	148	56	56
TSS (mg/L)	47	5	89	89	35	28	20	20	18	59	-228	-228
DOC (mg/L)	18.8	10.2	46	46	31.6	37.3	-18	-18	113	55.8	51	51
TOC (mg/L)	22.2	12.1	45	45	37.3	39.1	-5	-5	122	58.3	52	52
Total As (ug/L)	1.0	1.0	0	0	1.0	1.0	0	0	1.3	1.0	23	23
Total Cd (ug/L)	0.5	0.3	40	40	0.7	0.7	0	0	1.0	0.7	30	30
Total Cr (ug/L)	2.5	2.1	16	16	1.4	1.4	0	0	2.7	2.9	-7	-7
Total Cu (ug/L)	20	15	25	25	22	18	18	18	37	22	41	41
Total Pb (ug/L)	6.4	4.7	27	27	4.8	3.1	35	35	7.6	7.1	7	7
Total Ni (ug/L)	4	2.6	35	35	4.6	4.6	0	0	8.5	5.1	40	40
Total Zn (ug/L)	210	71	66	66	310	180	42	42	500	180	64	64
Dissolved As (ug/L)	1.0	1.0	0	0	1.0	1.0	0	0	1.1	1.0	9	9
Dissolved Cd (ug/L)	0.4	0.3	25	25	0.4	0.4	0	0	0.7	0.4	43	43
Dissolved Cr (ug/L)	1.4	1.7	-21	-21	1.0	1.0	0	0	1.8	1.6	11	11
Dissolved Cu (ug/L)	16	13	19	19	17	15	12	12	31	20	35	35
Dissolved Pb (ug/L)	3.7	3.5	5	5	1.1	1.4	-27	-27	4.8	3.1	35	35
Dissolved Ni (ug/L)	3.5	2.1	40	40	3.8	4.2	-11	-11	8.0	4.3	46	46
Dissolved Zn (ug/L)	180	68	62	62	240	170	29	29	470	170	64	64
Nitrate-Nitrogen (mg/L)	0.5	0.57	-14	-14	1.18	1.17	1	1	0.01	0.35	-3400	-3400
TKN (mg/L)	1.45	1.11	23	23	1.26	1.28	-2	-2	8.79	3.07	65	65
Total P (mg/L)	0.46	0.34	26	26	0.49	0.48	2	2	1.75	0.67	62	62
Diss. Ortho-Phosphate (mg/L)	0.1	0.03	70	70	0.03	0.12	-300	-300	0.59	0.41	31	31
Storm Volume (liters)	120789	120789			4538	4538			4222	4222		

Notes: Where EMC was non-detect then Reporting Limit was used.

Table 1-l
Water Quality Pollutant Removal Efficiencies for the Filmore Street CDS™ Unit
Scoping Study Methodology

	10/30/2001				11/12/2001				11/24/2001				11/29/2001				12/2/2001			
	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.
	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load
TDS (mg/L)	400	390	3	3	102	86	16	16	38	80	-111	-111	112	1	99	99	52	62	-19	-19
TSS (mg/L)	77	186	-142	-142	55	75	-36	-36	31	32	-3	-3	100	56	44	44	28	7	75	75
DOC (mg/L)	107	128	-20	-20	41.2	31.4	24	24	18.3	17.8	3	3	35.4	41.4	-17	-17	21	19.1	9	9
TOC (mg/L)	122	134	-10	-10	44.1	36	18	18	21.2	22.3	-5	-5	42.3	50.8	-20	-20	25.3	22	13	13
Total As (ug/L)	3.3	2.4	27	27	1.5	1.5	0	0	1.0	1.0	0	0	1.6	1.3	19	19	1.0	1.0	0	0
Total Cd (ug/L)	2.2	2.4	-9	-9	0.9	1.0	-11	-11	0.5	0.6	-20	-20	1.3	25.0	-1823	-1823	0.3	0.5	-67	-67
Total Cr (ug/L)	8.3	7.8	6	6	5.4	6.4	-19	-19	3.6	3.7	-3	-3	7.6	5.6	26	26	1.8	3.8	-111	-111
Total Cu (ug/L)	83	75	10	10	39	37	5	5	20	19	5	5	47	39	17	17	15	21	-40	-40
Total Pb (ug/L)	15	16	-7	-7	19	23	-21	-21	11	11	0	0	29	20	31	31	5.5	13	-136	-136
Total Ni (ug/L)	42	42	0	0	11	11	0	0	5.7	4.9	14	14	11	10	9	9	4.2	5.5	-31	-31
Total Zn (ug/L)	1500	1400	7	7	380	340	11	11	190	180	5	5	330	270	18	18	120	190	-58	-58
Dissolved As (ug/L)	2.8	2.0	29	29	1.2	1.0	17	17	1.0	1.0	0	0	1.2	1.2	0	0	1.0	1.0	0	0
Dissolved Cd (ug/L)	1.8	0.6	67	67	0.4	0.4	0	0	0.4	0.3	25	25	1.3	0.8	38	38	0.2	0.2	0	0
Dissolved Cr (ug/L)	3.7	4.1	-11	-11	2.2	2.2	0	0	1.8	1.8	0	0	4.4	4.3	2	2	1.8	2.0	-11	-11
Dissolved Cu (ug/L)	63	18	71	71	25	16	36	36	9.2	11	-20	-20	31	34	-10	-10	15	11	27	27
Dissolved Pb (ug/L)	3.3	3.4	-3	-3	2.1	2.1	0	0	1.0	1.2	-20	-20	13	14	-8	-8	4.5	4.0	11	11
Dissolved Ni (ug/L)	36	35.0	3	3	8.7	7.3	16	16	3.6	3.8	-6	-6	11	8.9	19	19	4.0	3.6	10	10
Dissolved Zn (ug/L)	1300	1200	8	8	240	180	25	25	120	140	-17	-17	210	230	-10	-10	110	100	9	9
Nitrate-Nitrogen (mg/L)	11	9.82	11	11	2.82	0.01	100	100	0.8	0.8	0	0	2.0	2.14	-7	-7	1.62	1.52	6	6
TKN (mg/L)	17.70	21	-19	-19	2.02	3.91	-94	-94	1.09	1.67	-53	-53	2.55	2.88	-13	-13	1.70	1.92	-13	-13
Total P (mg/L)	0.42	0.39	7	7	0.23	0.24	-4	-4	0.14	0.07	50	50	0.43	0.12	72	72	0.19	0.19	0	0
Diss. Ortho-Phosphate (mg/L)	0.4	0.43	-8	-8	0.11	0.03	73	73	0.03	0.03	0	0	0.03	0.03	0	0	0.03	0.03	0	0
Storm Volume (liters)	4159	4159			90926	90926			196892	196892			18267	18267			28216	28216		

	12/20/2001				1/27/2002				2/17/2002				3/6/2002				3/17/2002			
	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.	EMCs		Efficiency	% Diff.
	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load	Influent	Effluent	(%)	in Load
TDS (mg/L)	38	116	-205	-205	96	80	17	17	94	38	60	60	200	208	-4	-4	188	228	-21	-21
TSS (mg/L)	39	59	-51	-51	30	1	97	97	27	24	11	11	26	31	-19	-19	23	36	-57	-57
DOC (mg/L)	16.5	14.2	14	14	15.9	14	12	12	27	35.7	-32	-32	77.4	101	-30	-30	102	103	-1	-1
TOC (mg/L)	21.2	22.8	-8	-8	19.1	17.1	10	10	28.6	40	-40	-40	79.2	103	-30	-30	110	105	5	5
Total As (ug/L)	1.0	1.0	0	0	1.0	1.0	0	0	1.0	1.0	0	0	1.4	1.6	-14	-14	1.3	1.3	0	0
Total Cd (ug/L)	0.4	0.3	25	25	0.5	0.4	20	20	0.5	0.7	-40	-40	0.9	1.1	-22	-22	0.9	1.1	-22	-22
Total Cr (ug/L)	3.6	3.1	14	14	2.7	2.3	15	15	1.7	2.1	-24	-24	2.6	3.4	-31	-31	3.4	3.6	-6	-6
Total Cu (ug/L)	18	16	11	11	18	15	17	17	19	22	-16	-16	32	42	-31	-31	35	38	-9	-9
Total Pb (ug/L)	11	8.8	20	20	7.5	5.1	32	32	5.9	6.3	-7	-7	9.0	12	-33	-33	13	14	-8	-8
Total Ni (ug/L)	4.2	3.8	10	10	4.0	3.7	8	7	5.5	7.2	-31	-31	14	21	-50	-50	14	16	-14	-14
Total Zn (ug/L)	130	120	8	8	140	110	21	21	210	260	-24	-24	460	590	-28	-28	470	530	-13	-13
Dissolved As (ug/L)	1.0	1.0	0	0	1.0	1.0	0	0	1.0	1.0	0	0	1.3	1.5	-15	-15	1.2	1.2	0	0
Dissolved Cd (ug/L)	0.2	0.2	0	0	0.4	0.4	0	0	0.4	0.5	-25	-25	0.7	1	-43	-43	0.8	0.9	-13	-13
Dissolved Cr (ug/L)	1.5	1.6	-7	-7	2.3	2.1	9	9	1.1	1.1	0	0	1.8	2.2	-22	-22	2.6	2.6	0	0
Dissolved Cu (ug/L)	9.6	9.9	-3	-3	14	14	0	0	15	17	-13	-13	26	36	-38	-38	32	33	-3	-3
Dissolved Pb (ug/L)	1.0	1.0	0	0	4.4	4.5	-2	-2	1.1	1.5	-36	-36	6.3	9	-43	-43	8.9	9.1	-2	-2
Dissolved Ni (ug/L)	2.5	2.6	-4	-4	3.4	3.4	0	0	4.7	6.3	-34	-34	12	18.0	-50	-50	14	15.0	-7	-7
Dissolved Zn (ug/L)	72	75	-4	-4	110	110	0	0	160	240	-50	-50	390	550	-41	-41	460	500	-9	-9
Nitrate-Nitrogen (mg/L)	0.79	0.79	0	0	0.85	0.72	15	15	0.97	1.04	-7	-7	2.66	2.7	-2	-2	0.1	0.04	60	60
TKN (mg/L)	2.52	1.91	24	24	1.48	1.36	8	8	0.74	0.99	-34	-34	3.4	5.95	-75	-75	3.99	4.73	-19	-19
Total P (mg/L)	0.14	0.01	93	93	0.34	0.32	6	6	0.35	0.23	34	34	0.4	0.47	-18	-18	0.33	0.39	-18	-18
Diss. Ortho-Phosphate (mg/L)	0.03	0.03	0	0	0.03	0.03	0	0	0.03	0.03	0	0	0.12	0.18	-50	-50	0.13	0.18	-38	-38
Storm Volume (liters)	65797	65797			201739	201739			35977	35977			7106	7106			8552	8552		

Notes: Where EMC was non-detect then Reporting Limit was used.

Table 1-m

2001/02 Wet Season Water Quality Pollutant Removal Efficiencies for the CDS™ Units
Scoping Study Methodology

Orcas Avenue CDS™ Unit

2001/02 Wet Season Statistics

Parameter	Minimum Load Removal (%)	Maximum Load Removal (%)	Average Season Removal (%)
TDS	-71	59	46
TSS	-228	89	11
DOC	-18	51	33
TOC	-5	52	35
Total-As	0	29	12
Total-Cd	-25	40	15
Total-Cr	-17	16	-2
Total-Cu	-35	41	20
Total-Pb	-44	35	6
Total-Ni	-84	40	12
Total-Zn	24	66	48
Dissolved-As	0	23	6
Dissolved-Cd	0	43	21
Dissolved-Cr	-25	11	-13
Dissolved-Cu	-20	42	24
Dissolved-Pb	-27	35	13
Dissolved-Ni	-71	46	11
Dissolved-Zn	4	64	49
Nitrate-Nitrogen	-3400	66	83
TKN	-2	65	42
Total-P	-750	62	59
Dissolved Ortho-Phosphate	-300	70	20

Total Influent Flow for Season(L): 309528

Total Effluent Flow for Season (L): 309528

Filmore Street CDS™ Unit

2001/02 Wet Season Statistics

Parameter	Minimum Load Removal (%)	Maximum Load Removal (%)	Average Season Removal (%)
TDS	-205	99	-100
TSS	-142	97	-81
DOC	-32	24	-11
TOC	-40	18	-9
Total-As	-14	27	7
Total-Cd	-1823	25	-177
Total-Cr	-111	26	-2
Total-Cu	-40	17	0
Total-Pb	-136	32	-4
Total-Ni	-50	14	-10
Total-Zn	-58	21	-3
Dissolved-As	-15	29	6
Dissolved-Cd	-43	67	19
Dissolved-Cr	-22	9	-4
Dissolved-Cu	-38	71	17
Dissolved-Pb	-43	11	-8
Dissolved-Ni	-50	19	-5
Dissolved-Zn	-50	25	-8
Nitrate-Nitrogen	-7	100	-91
TKN	-94	24	-27
Total-P	-18	93	-9
Dissolved Ortho-Phosphate	-50	73	-4

Total Influent Flow for Season(L): 789366

Total Effluent Flow for Season (L): 789366

Notes:

Total influent and effluent flows for season at the Orcas Avenue and Filmore Street CDS™ units includes flows that occurred during non-monitored storm events.

Table 1-n

2000/02 Study Period Water Quality Pollutant Removal Efficiencies for the CDS™ Units
Scoping Study Methodology

Orcas Avenue CDS™ Unit

2000/02 Study Period Statistics

Parameter	Minimum Load Removal (%)	Maximum Load Removal (%)	Average Study Period Removal (%)
TDS	-71	59	33
TSS	-228	89	18
DOC	-18	51	31
TOC	-5	52	33
Total-As	0	63	18
Total-Cd	-25	40	16
Total-Cr	-17	39	11
Total-Cu	-35	50	24
Total-Pb	-44	79	32
Total-Ni	-84	42	15
Total-Zn	6	66	48
Dissolved-As	0	67	15
Dissolved-Cd	-100	43	11
Dissolved-Cr	-40	11	-13
Dissolved-Cu	-20	42	18
Dissolved-Pb	-27	35	11
Dissolved-Ni	-71	46	8
Dissolved-Zn	-35	64	45
Nitrate-Nitrogen	-3400	66	60
TKN	-59	65	35
Total-P	-750	62	40
Dissolved Ortho-Phosphate	-300	70	14

Total Influent Flow for Study Period (L): 1319929

Total Effluent Flow for Study Period (L): 1319929

Filmore Street CDS™ Unit

2000/02 Study Period Statistics

Parameter	Minimum Load Removal (%)	Maximum Load Removal (%)	Average Study Period Removal (%)
TDS	-205	99	-23
TSS	-142	97	-34
DOC	-77	47	-4
TOC	-40	28	-6
Total-As	-640	69	2
Total-Cd	-1823	25	-92
Total-Cr	-111	26	-4
Total-Cu	-40	18	0
Total-Pb	-136	32	-2
Total-Ni	-50	15	-7
Total-Zn	-58	24	-1
Dissolved-As	-15	68	14
Dissolved-Cd	-43	67	18
Dissolved-Cr	-22	38	2
Dissolved-Cu	-38	71	16
Dissolved-Pb	-43	29	1
Dissolved-Ni	-50	38	-1
Dissolved-Zn	-50	48	-4
Nitrate-Nitrogen	-8	100	-13
TKN	-94	85	-20
Total-P	-129	93	1
Dissolved Ortho-Phosphate	-50	73	3

Total Influent Flow for Study Period (L): 3572712

Total Effluent Flow for Study Period (L): 3572712

Notes:

Total influent and effluent flows for study period at the Orcas Avenue and Filmore Street CDS™ units includes flows that occurred during non-monitored storm events.

Table 1-o

Data Sets Not Log Normally Distributed

Location	Constituent	Possible Cause
Influent Orcas Avenue CDS™ Unit	Total As	Large number of Non-Detects
Influent Orcas Avenue CDS™ Unit	Dissolved As	Large number of Non-Detects
Influent Orcas Avenue CDS™ Unit	Dissolved Ni	High variability
Influent Filmore Street CDS™ Unit	Total As	Large number of Non-Detects
Influent Filmore Street CDS™ Unit	Dissolved As	Large number of Non-Detects
Influent Filmore Street CDS™ Unit	Dissolved Ortho-P	Outlier
Effluent Filmore Street CDS™ Unit	TDS	High variability
Effluent Filmore Street CDS™ Unit	Total As	Large number of Non-Detects
Effluent Filmore Street CDS™ Unit	Total Cd	Outlier
Effluent Filmore Street CDS™ Unit	Dissolved As	Large number of Non-Detects
Effluent Filmore Street CDS™ Unit	Total P	High variability
Effluent Filmore Street CDS™ Unit	Dissolved Ortho-P	Outlier

2.0 CDS™ OPERATIONS

Performance assessments of CDS™ operations were determined using empirical observations (Form H of the OMM Volume II *Field Guidance Notebooks*). Empirical observations were taken at variable times during monitored events. Field crews assessed BMP operations at the beginning, middle and end of a storm event. Traffic, weather and insufficient light sometimes limited these observations.

Observations generally provided information on the following:

- Present meteorological characteristics.
- Rainfall (start times and intensity indication).
- Hydrologic and hydraulic characteristics (flowing and/or standing water, flow-bypass).
- Water level.
- Inlet conditions (problems affecting performance).
- Evidence of debris (organic or trash), scouring, re-suspension or erosion.
- Description of amount and location of sediment accumulation.
- Inlet and outlet water quality appearance (visual, olfactory, presence of oil and grease).
- Presence of vectors.
- Outlet conditions (problems affecting performance).
- Structural condition of facility.

Other site-specific observations were performed according to the checklists presented in Form H.

2.1 Evaluation of the CDS™ Units

Tables 2-a and 2-b summarize empirical observations of the CDS™ units' performance. More detail on BMP operations is available at the following web site:
http://www.rbf.com/caltrans

2.1.1 Overall Review of the CDS™ Units

During the early part of the previous wet season, several modifications to the CDS™ units were completed. These included removing the CDS™ screens and installing CDS™ separation screens with larger openings. Currently, the Orcas Avenue CDS™ unit has a 2.4-mm opening screen and the Filmore Street CDS™ unit has a 4.7-mm opening screen.

Because these devices are designed to retain water in the sump for proper operation during the storm season, additional modifications were made. This included sealing holes and bolting down the lids of the units and trying several different styles of bypass bags before settling on more pliable mosquito bags with chain weighted ends. During subsequent storms, these bags did not impede the flow of stormwater and they allowed trash and debris that bypassed the CDS™ unit to be captured in the downstream litter bypass baskets. The residual water was monitored for mosquito populations by the vector control agencies.

Following these changes, mosquito breeding was observed on April 30, 2002 at the Orcas Avenue CDS™ unit. No mosquitoes or mosquito breeding was observed at the Filmore Street CDS unit. No other modifications were made during the 2001/02 wet season.

2.1.2 Orcas Avenue CDS™ Unit

During each monitored event, the Orcas Avenue CDS™ unit generally operated according to design. However, due to site-specific characteristics of the area more organic debris entered the Orcas Avenue CDS™ unit than at the Filmore Street CDS™ unit, resulting in additional maintenance. Based on observations, the probable source of the leaves and horse manure that entered the Orcas Avenue CDS™ unit is the park and stables located on the south side of the I-210 freeway. The sound wall next to the CDS™ drain inlets traps these materials and they accumulate.

During the 2000/01 wet season, debris, such as foam plates, blocked the entrance to the Orcas Avenue CDS™ unit, however no blockage was noticed during the 2001/02 wet season.

Sediment settled in the corners of the weir box. Some sediment in suspension passed into the CDS™ unit and settled in the sump litter basket. Some sediment bypassed the CDS™ unit and deposited in the H-flume. Sediment was also deposited in the annulus between the screen within the CDS™ unit and the inner wall of the unit, as well as in the bottom of the sump.

In general, the appearance of the stormwater was improved. The appearance of the effluent stormwater was slightly clearer than the influent stormwater. When oil and grease sheen was observed in the influent stormwater, it was also observed in the effluent stormwater, but to a lesser extent.

Mosquitoes were not observed during storm events and the monthly inspections. However, during the last cleanout, the vector control agency observed some mosquito body parts. Mosquitoes may have entered the Orcas CDS™ unit through a fold at the end of the bypass bag.

2.1.3 Filmore Street CDS™ Unit

During the 2000/01 wet season, debris, such as foam plates, blocked the entrance to the Filmore Street CDS™ unit, however no blockage by foam plates was noticed during the 2001/02 wet season. During the storm event on November 12, 2001, a large amount of organic debris blocked the entrance to the Filmore Street CDS™ unit. This debris was pushed into the CDS™ unit by stormwater runoff during the storm event.

Sediment settled in the corners of the weir box. Some sediment in suspension passed into the CDS™ unit and settled in the sump litter basket. Some sediment bypassed the CDS™ unit and deposited in the H-flume. Sediment was also deposited in the annulus between the

screen within the CDS™ unit and the inner wall of the unit, as well as in the bottom of the sump.

In general, the appearance of the stormwater was improved. The appearance of the effluent stormwater was slightly clearer than the influent stormwater. When oil and grease sheen was observed in the influent stormwater, it was also observed in the effluent stormwater, but to a lesser extent. However, due to tar that entered the Filmore Street CDS™ unit at the beginning of the wet season, the effluent had a persistent sheen that lessened as the wet season progressed.

Table 2-a: Operational Performance of the Orcas Avenue CDS™ Unit

No. of Storm Events	Hydrologic/ Hydraulic Characteristics	Inlet Conditions	Water Quality	Solids Deposition/ Re-suspension	Erosion	Vegetation	Outlet	Comments
7	Generally functioned as designed. Bypass was observed during 3 of 7 storm events. The downstream flow through mosquito-proofing tube did not impede flow through the CDS™ unit during the season.	Functioned properly during design flows. Due to the small inlet from the weir box to the CDS™ unit, relatively large quantities of mostly organics created a blockage. This generally occurred in November and December 2001 and in March 2002.	Inlet water conditions commonly had a scummy film, oily sheen, and were gray to brown in color. On a few occasions an oily sheen was observed to a lesser extent in the effluent. Slightly less suspended solids were observed in the effluent compared to influent during a few storm events. Otherwise, the turbidity was generally the same. During one storm, the turbidity appeared to increase.	Due to site-specific conditions of the drainage area, trash and debris generally consisted of organic materials. Sediment accumulated in the weir box and some sediment accumulated in the H-flume.	None.	None.	Functioned as designed.	The Orcas Avenue CDS™ unit was cleaned out four times during the wet season and once at the end of the wet season on May 6, 2002. Based on observations of the wind, the probable source of the leaves and horse manure was from the park and stables located on the south side of the I-210. The sound wall next to the CDS™ drain inlets traps this debris.

Table 2-b: Operational Performance of the Filmore Street CDS™ Unit

No. of Storm Events	Hydrologic/ Hydraulic Characteristics	Inlet Conditions	Water Quality	Solids Deposition/ Re-suspension	Erosion	Vegetation	Outlet	Comments
10	Generally functioned as designed. Bypass was observed during 3 of 10 storm events. Flow through the downstream mosquito-proofing tube did not impede flow through the CDS™ unit.	Functioned properly during design flows. Smaller quantities of trash and debris were observed in the latter part of the wet season.	At the beginning of the wet season, tar had seeped into the CDS™ unit from resurfacing of the roadways. Inlet water conditions commonly had a scummy film, oily sheen, and were brown in color. On a few occasions an oily sheen was observed to a lesser extent in the latter part of the wet season. Suspended solids were generally similar in the effluent and influent.	Sediment accumulated in the weir box and some sediment accumulated in the H-flume.	Erosion around the outside of the CDS™ unit occurred from water overtopping the CDS™ unit during large storm events and from gopher activity around the inlet pipe.	None.	Functioned as designed.	The CDS™ unit was cleaned out once at the end of the wet season on April 25, 2002.

3.0 CDS™ INSPECTION AND SITE MAINTENANCE

The primary objective of the inspection and maintenance of the CDS™ units is to make sure that the sites are properly maintained to achieve optimum performance. Aesthetic, preventative, and corrective maintenance measures, if conducted, were performed in accordance with the OMM Plan dated September 1999 and the Maintenance Indicator Document (MID) dated November 16, 2001.

Aesthetic Maintenance includes:

- Graffiti removal
- Landscaping

Preventative maintenance includes:

- Trash and debris removal
- Sediment removal
- Vector abatement (eliminating mosquito breeding habitats)

Corrective maintenance includes:

- Removal of debris and sediment
- Structural repairs
- Elimination of mosquito breeding areas
- Erosion repair
- Fence repair
- Elimination of animal burrows
- General facility maintenance

Maintenance inspections were conducted on a monthly basis. The inspections were also conducted during storm event observation and after each storm event greater than 19.05 millimeters (0.75 inches). Dates for the monthly inspections and storm event observations are provided for the Orcas Avenue CDS™ unit in Table 3-a and the Filmore Street CDS™ unit in Table 3-b.

Maintenance needs observed during inspections were documented on the “BMP Site Inspection Checklist for Continuous Deflective Separation Units” (Form C of the OMM Plan Volume II Field Guidance Notebooks). Based on this documentation, immediate maintenance needs were arranged and conducted. The details of the maintenance activities conducted were documented on the "BMP Site Maintenance Activity Checklist for Continuous Deflective Separation Units" (Form E of the OMM Plan Volume II Field Guidance Notebooks).

3.1 Summary of Inspection and Maintenance Activities

2001/02 wet season maintenance and inspection activities at the CDS™ units were performed in accordance with the MID and OMM Plan. The maintenance and inspection activities for the 2001/02 wet season consisted of the following:

1. Monthly inspection

2. Landscaping maintenance and graffiti removal.

3. Inspecting and repairing the mosquito-proofing modifications that were made during the 2000/01 wet season, which include the modified bypass bag, weather stripping on the CDS™ cover and the weir box cover, the CDS™ cover hold down bolts, and the holes in the units filled with silicone sealant.

4. Cleaning out gross pollutants (litter and vegetation) from the weir box, sump, and bypass bag. Clearing the weir box of sediment and debris was accomplished by pushing it into the sump. The maintenance threshold for gross pollutants in the sump was set at 85% full or 50 % full during two consecutive monthly inspections and annually in May. Cleanout of the floatable debris was set at 10 or more inches. Both CDS™ units were cleaned out at the end of the 2001/02 wet season.

Figure 3-1 illustrates the frequency of maintenance activities (number of times maintenance was conducted) at the CDS™ units. Figure 3-2 illustrates the average amount of time spent performing each maintenance activity.

3.1.1 Orcas Avenue CDS™ Unit

Site-specific maintenance activities performed at the Orcas Avenue CDS™ unit consisted of the following:

1. The sump water collected during the end of the 2000/01 wet season cleanout of the Orcas Avenue CDS™ was removed from the premises on August 17, 2001.

2. A tree hanging over the top of the fence surrounding the site was trimmed back on September 19, 2001.

3. A large amount of organic debris had collected in the weir box during the storm event on November 24, 2001. This debris was pushed into the sump of the CDS™ unit during the storm.

4. During the wet season, the Orcas Avenue CDS™ unit sump was cleaned out on November 19 and 28, 2001 and January 9 and 30, 2002. The cleanouts on November 19, 2001 and January 9, 2002 involved the removal of floatable debris only. The cleanouts on November 28, 2001 and January 30, 2002 included the

removal of floatable debris, settleable debris, and bypass debris. The cleanout for the end of the wet season was conducted on May 6, 2002.

5. Following each cleanout, the holes in the CDS™ unit were refilled with silicon sealant to prevent mosquitoes from entering the CDS™ unit.

6. Dewatering of the Orcas Avenue CDS™ unit was conducted during the final cleanout on May 6, 2002.

A summary of floatable and settleable debris depth measurements as well as cleanout dates conducted during the 2001/02 wet season at the Orcas Avenue CDS™ unit is presented in Table 3-a.

3.1.2 Filmore Street CDS™ Unit

Site-specific maintenance activities at the Filmore Street CDS™ unit consisted of the following:

1. The sump water collected during the end of the 2000/01 wet season cleanout of the Filmore Street CDS™ was removed from the premises on August 17, 2001.

2. Holes in the bypass bag of the Filmore Street CDS™ unit were repaired (sewn) on September 14, 2001.

3. Removal of graffiti from the enclosure, fence, and flume of the Filmore Street CDS™ unit was conducted on September 17, 2001.

4. The cleanout for the end of the 2001/02 wet season at the Filmore Street CDS™ unit was conducted on April 25, 2002. No other cleanouts were performed at the Filmore Street CDS™ unit during the 2001/2002 wet season.

5. Following the cleanout, the holes in the CDS™ unit were filled with silicon sealant to prevent mosquitoes from entering the CDS™ unit.

6. Dewatering of the Filmore Street CDS™ unit was conducted during the final cleanout on April 25, 2002.

A summary of floatable and settleable debris depth measurements as well as cleanout dates conducted during the 2001/02 wet season at the Filmore Street CDS™ unit is presented in Table 3-b.

Figure 3-1
Frequency of Maintenance Activities for the CDS™ Units

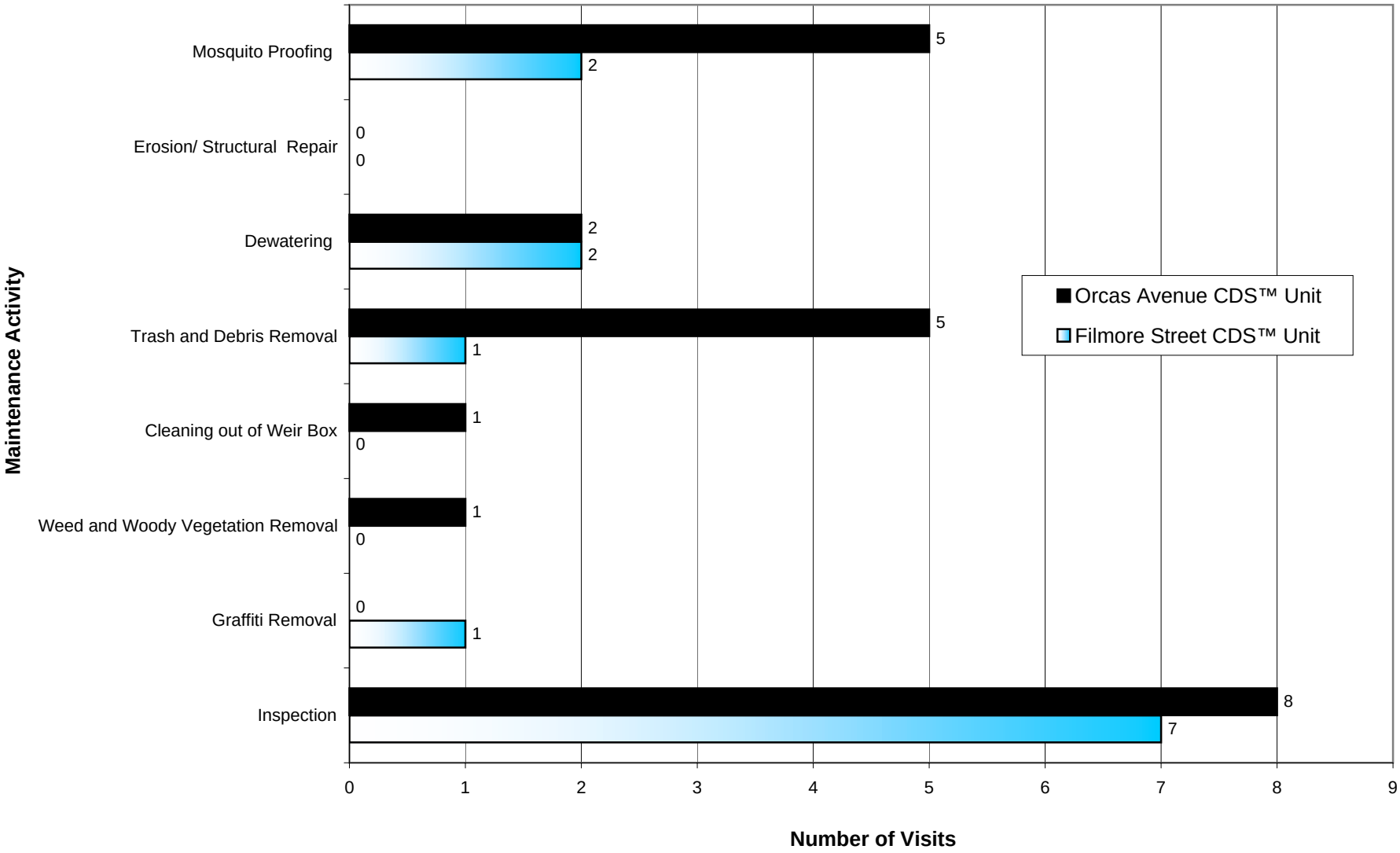


Figure 3-2
Average Maintenance Times for the CDS™ Units

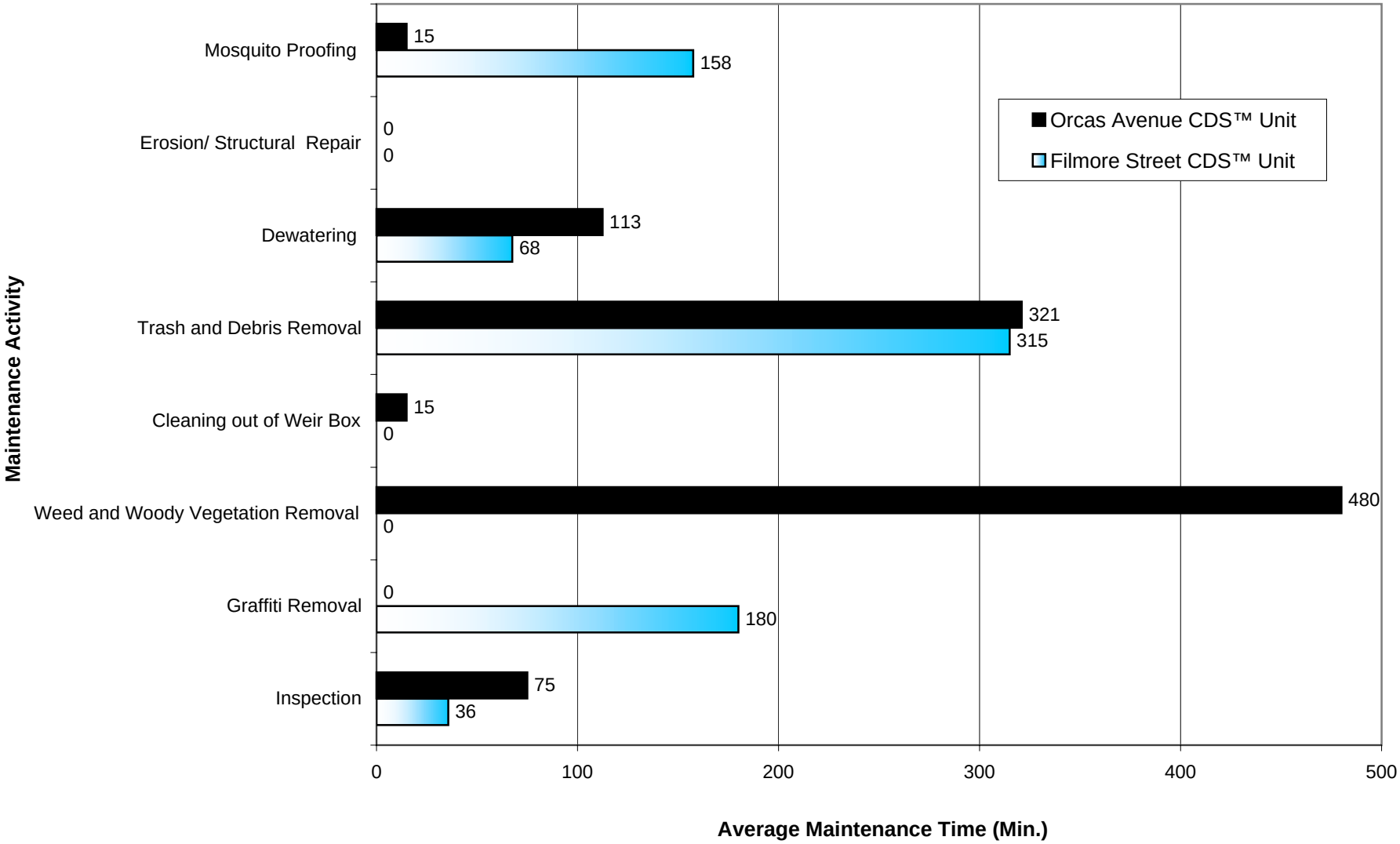


Table 3-a

Cleanout, Inspection, and Storm Observation Dates and Depths of Settleable/Floatable Gross Pollutants for the Orcas Avenue CDS™ Unit

Date	Activity	Settleable (mm)	Settleable (in)	Floatable (mm)	Floatable (in)
Sept. 13, 2001	Monthly Inspection	0	0	0	0
Oct. 10, 2001	Monthly Inspection	0	0	0	0
Oct. 30, 2001	Storm Observation	0	0	0	0
Nov. 6, 2001	Monthly Inspection	0	0	0	0
Nov. 12, 2001	Storm Observation[1]	76.2	3	381	15
Nov. 19, 2001	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
Nov. 24,2001	Storm Observation[1]	Unable to get accurate measurement of depth due to flow in the CDS™ unit.			
Nov. 28, 2001	Cleanout Inspection	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
Nov. 28, 2001	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
Nov. 29, 2001	Storm Observation[1]	Unable to get accurate measurement of depth due to flow in the CDS™ unit.			
Dec. 2, 2001	Storm Observation	Unable to get accurate measurement of depth due to flow in the CDS unit.			
Dec. 5, 2001	Monthly Inspection	0.0 - 6.4	0.0 - 0.3	0.0 - 3.2	0.0 - 0.1
Dec. 20, 2001	Storm Observation[1]	0	0	304.8	12
Jan. 8, 2002	Monthly Inspection	38.1 - 50.8	1.5 - 2.0	254	10
Jan. 9, 2002	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
Jan. 27, 2002	Storm Observation[1]	939.8	37	25.4	1
Jan. 30, 2002	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
Feb. 6, 2002	Monthly Inspection	.1 through 1.4.2 for de	0	0	0
Feb. 17, 2002	Storm Observation[1]	177.8	7	2.54	0.1
Mar. 6, 2002	Storm Observation	Unable to get accurate measurement of depth due to flow in the CDS™ unit.			
Mar. 17, 2002	Storm Observation[1]	Unable to get accurate measurement of depth due to flow in the CDS™ unit.			
May 6, 2002	Cleanout Inspection	See Sections 1.4.1 through 1.4.2 for details of cleanout.			
May 6, 2002	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			

[1] The storm observation was also sampled a storm event.

Table 3-b

Cleanout, Inspection, and Storm Observation Dates and Depths of Settleable/Floatable Gross Pollutants for the Filmore Street CDS™ Units

Date	Activity	Settleable (mm)	Settleable (in)	Floatables (mm)	Floatables (in)
Sept. 13, 2001	Monthly Inspection	0.0	0.0	0.0	0.0
Oct. 10, 2001	Monthly Inspection	0.0	0.0	0.0	0.0
Oct. 30, 2001	Storm Observation[1]	0.0	0.0	0.0	0.0
Nov. 6, 2001	Monthly Inspection	0.0	0.0	6.4	0.3
Nov. 12, 2001	Storm Observation[1]	241.3	9.5	25.4	1.0
Nov. 24,2001	Storm Observation[1]	190.0	7.5	<0.50	<0.02
Nov,. 29, 2001	Storm Observation[1]	230.0	9.1	<0.50	<0.02
Dec. 2, 2001	Storm Observation[1]	0.0	0.0	0.0	0.0
Dec. 5, 2001	Monthly Inspection	152.4 - 203.2	6.0 - 8.0	50.8	2.0
Dec. 20, 2001	Storm Observation[1]	<0.50	<0.02	<0.50	<0.02
Jan. 8, 2002	Monthly Inspection	279.4	11.0	25.4	1.0
Jan. 27, 2002	Storm Observation[1]	381.0	15.0	25.4	1.0
Feb. 6, 2002	Monthly Inspection	330.2	13.0	25.4	1.0
Feb. 17, 2002	Storm Observation[1]	177.8	7.0	2.5	0.1
Mar. 6, 2002	Storm Observation[1]	370.8	14.6	<0.50	<0.02
Mar. 17, 2002	Storm Observation[1]	393.7	15.5	<0.50	<0.02
Apr. 25, 2002	Cleanout Inspection	330.2 - 355.6	13.0 - 14.0	50.8	2.0
Apr. 25, 2002	Unit Cleaned	See Sections 1.4.1 through 1.4.2 for details of cleanout.			

[1] The storm observation was also sampled a storm event.

4.0 COST SUMMARY

A cost summary for maintenance of the Orcas Avenue CDS™ unit during the 2001/02 wet season is provided in Table 4-a. A cost summary for maintenance of the Filmore Street CDS™ unit during the 2001/02 wet season is provided in Table 4-b. These tables cover the period from July 1, 2001 to April 30, 2002. These cost summaries provide maintenance hours with generic rates.

Table 4-a
Cost Summary for the Orcas Avenue CDS™ Unit

DISTRICT: 7	LOCATION: I-210/East of Orcas Avenue	SITE NO. 73102	BMP TYPE: Continuous Deflective Separation Unit

	TASK	2001 Jul	Aug	Sep	Oct	Nov	Dec	2002 Jan	Feb	Mar	Apr	May	Jun	Total (hrs)	Avg. Rate	TOTAL $
Labor (hours)	***Administration***															
	General program support/Follow-up	1.83	5.95	5.75	2.33	5.33	8.10	30.18	10.11	12.32	35.54	30.26		147.70	$120	$ 17,724
	Encroachment Permits													0.00	$87	$ -
	Travel		1.09	1.74	1.82	5.92	5.19	13.61	4.82	0.74	1.74	3.98		40.65	$87	$ 3,537
	Unscheduled events													0.00	$87	$ -
	Monthly Subtotal (hours)	1.83	7.04	7.49	4.15	11.25	13.29	43.79	14.93	13.06	37.28	34.24	0.00	188.35		
	Monthly Subtotal ($)	$220	$809	$841	$438	$1,155	$1,424	$4,806	$1,633	$1,543	$4,416	$3,977	$0	$21,261		
														Task Subtotal =		$21,261
	Operation															
	Wet season inspections				2.75	1.25	1.00	1.00	5.00	0.50	1.00			12.50	$55	$ 688
	Dry season inspections			1.00								1.25		2.25	$55	$ 124
	Unscheduled inspections/field calls													0.00	$60	$ -
	Monthly Subtotal (hours)	0.00	0.00	1.00	2.75	1.25	1.00	1.00	5.00	0.50	1.00	1.25	0.00	14.75		
	Monthly Subtotal ($)	$0	$0	$55	$151	$69	$55	$55	$275	$28	$55	$69	$0	$811		
														Task Subtotal =		$811
	Maintenance															
	Scheduled maintenance		0.75	8.25		13.00	11.50	53.50	10.75			37.00		134.75	$55	$ 7,411
	Unscheduled maintenance													0.00	$55	$ -
	Vandalism													0.00	$55	$ -
	Acts of God													0.00	$55	$ -
	Landscape Maintenance Contractor													0.00	$0	$ -
	Sediment Removal Contractor													0.00	$0	$ -
	Vegetation Consultant													0.00	$75	$ -
	Other Contractor													0.00	$0	$ -
	Other Contractor													0.00	$0	$ -
	Monthly Subtotal (hours)	0.00	0.75	8.25	0.00	13.00	11.50	53.50	10.75	0.00	0.00	37.00	0.00	134.75		
	Monthly Subtotal ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
														Task Subtotal =		$7,411
	Vector Control															
	Contract & General administration				1.00									1.00	$120	$ 120
	Vector prevention maint. (consultant)													0.00	$65	$ -
	Response to VCD calls (consultant)													0.00	$55	$ -
	VCD efforts (contracted)	3.83	4.20	5.40	7.72	7.39	10.51	8.75	7.66	7.28	7.59	9.23		79.56	$46	$ 3,696
	Monthly Subtotal (hours)	3.83	4.20	5.40	8.72	7.39	10.51	8.75	7.66	7.28	7.59	9.23	0.00	80.56		
	Monthly Subtotal ($)	$178	$195	$251	$479	$343	$488	$406	$356	$338	$353	$429	$0	$3,816		
														Task Subtotal =		$3,816
Non-Recurring Equipment (hours)	***Equipment***															
	Generator											8.00		8.00	$5	$ 40
	Compressor pump											8.00		8.00	$5	$ 40
	Shop vacuum											8.00		8.00	$5	$ 40
	Piece of Equipment 4													0.00	$0	$ -
	Piece of Equipment 5													0.00	$0	$ -
	Piece of Equipment 6													0.00	$0	$ -
	Monthly Subtotal (hours)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	0.00	24.00		
	Monthly Subtotal ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$120	$0	$120		
														Equipment Subtotal =		$120

	Direct Costs													Total $
Dollars ($)	VCD supplies (direct costs less labor)				$ 410									$ 410
	Reproduction													$ -
	Postage/FedEx	$ 0.3	$ 2		$ 1				$ 1					$ 4
	Lodging											$ 4		$ 4
	Per Diem											$ 1.1		$ 1
	Incidentals													$ -
	Vehicle Rental/Lease		$ 20	$ 12	$ 18	$ 23	$ 8	$ 184	$ 29	$ 12	$ 7	$ 9		$ 321
	Airfare													$ -
	Field Supp./Expendables				$ 2			$ 63	$ 10			$ 1,176		$ 1,251
	Equipment Rental													$ -
	Sediment Analyses													$ -
	Waste Disposal			$ 767										$ 767
	Weed Wacker													$ -
	Vegetation Disposal													$ -
	Storage Container													$ -
	Monthly Subtotal	$ 0	$ 22	$ 779	$ 431	$ 23	$ 8	$ 247	$ 40	$ 12	$ 7	$ 1,191	$ -	$ 2,759

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	2001/2002 TOTAL =
MONTHLY TOTAL	$398	$1,026	$1,926	$1,499	$1,590	$1,974	$5,515	$2,303	$1,920	$4,831	$5,785	$0	**$36,178**

Table 4-b
Cost Summary for the Filmore Street CDS™ Uni

DISTRICT: 7	LOCATION: I-210/East of Filmore Street	SITE NO. 73103	BMP TYPE: Continuous Deflective Separation Unit	

	TASK	2001						2002						Total (hrs)	Avg. Rate	TOTAL $
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun			
Labor (hours)	***Administration***															
	General program support/Follow-up	1.83	5.95	5.75	2.33	1.78	5.40	15.09	5.05	12.32	35.54	21.62		112.66	$120	$ 13,519
	Encroachment Permits													0.00	$87	$ -
	Travel		1.09	1.31	1.82	1.18	3.11	5.83	1.61	1.47	6.96	2.65		27.03	$87	$ 2,352
	Unscheduled events													0.00	$87	$ -
	Monthly Subtotal (hours)	1.83	7.04	7.06	4.15	2.96	8.51	20.92	6.66	13.79	42.50	24.27	0.00	139.69		
	Monthly Subtotal ($)	$220	$809	$804	$438	$316	$919	$2,318	$746	$1,606	$4,870	$2,825	$0	$15,871		
														Task Subtotal =		$15,871
	Operation															
	Wet season inspections				2.75	1.25	1.00	1.00	1.00	0.50	1.00			8.50	$55	$ 468
	Dry season inspections			1.00								0.25		1.25	$55	$ 69
	Unscheduled inspections/field calls													0.00	$60	$ -
	Monthly Subtotal (hours)	0.00	0.00	1.00	2.75	1.25	1.00	1.00	1.00	0.50	1.00	0.25	0.00	9.75		
	Monthly Subtotal ($)	$0	$0	$55	$151	$69	$55	$55	$55	$28	$55	$14	$0	$536		
														Task Subtotal =		$536
	Maintenance															
	Scheduled maintenance		0.75	5.50				0.50		1.00	56.75	13.00		77.50	$55	$ 4,263
	Unscheduled maintenance													0.00	$55	$ -
	Vandalism													0.00	$55	$ -
	Acts of God													0.00	$55	$ -
	Landscape Maintenance Contractor													0.00	$0	$ -
	Sediment Removal Contractor													0.00	$0	$ -
	Vegetation Consultant													0.00	$75	$ -
	Other Contractor													0.00	$0	$ -
	Other Contractor													0.00	$0	$ -
	Monthly Subtotal (hours)	0.00	0.75	5.50	0.00	0.00	0.00	0.50	0.00	1.00	56.75	13.00	0.00	77.50		
	Monthly Subtotal ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
														Task Subtotal =		$4,263
	Vector Control															
	Contract & General administration				1.00									1.00	$120	$ 120
	Vector prevention maint. (consultant)													0.00	$65	$ -
	Response to VCD calls (consultant)													0.00	$55	$ -
	VCD efforts (contracted)	3.84	4.16	5.24	7.72	7.39	9.96	8.75	7.70	7.38	7.64	8.84		78.62	$46	$ 3,652
	Monthly Subtotal (hours)	3.84	4.16	5.24	8.72	7.39	9.96	8.75	7.70	7.38	7.64	8.84	0.00	79.62		
	Monthly Subtotal ($)	$178	$193	$243	$479	$343	$463	$406	$358	$343	$355	$411	$0	$3,772		
														Task Subtotal =		$3,772
Non-Recurring Equipment (hours)	***Equipment***															
	Generator										8.00			8.00	$5	$ 40
	Compressor pump										8.00			8.00	$5	$ 40
	Shop vacuum										8.00			8.00	$5	$ 40
	Piece of Equipment 4													0.00	$0	$ -
	Piece of Equipment 5													0.00	$0	$ -
	Piece of Equipment 6													0.00	$0	$ -
	Monthly Subtotal (hours)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	0.00	0.00	24.00		
	Monthly Subtotal ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$120	$0	$0	$120		
														Equipment Subtotal =		$120

Dollars ($)	*Direct Costs*													Total $
	VCD supplies (direct costs less labor)				$ 410									$ 410
	Reproduction													$ -
	Postage/FedEx	$ 0.3	$ 2		$ 1				$ 0					$ 4
	Lodging											$ 4		$ 4
	Per Diem											$ 1.1		$ 1
	Incidentals													$ -
	Vehicle Rental/Lease		$ 20	$ 9	$ 18	$ 5	$ 5	$ 79	$ 10	$ 23	$ 28	$ 6		$ 202
	Airfare													$ -
	Field Supp./Expendables				$ 2				$ 3		$ 1,231.88			$ 1,237
	Equipment Rental													$ -
	Sediment Analyses													$ -
	Waste Disposal			$ 767										$ 767
	Weed Wacker													$ -
	Vegetation Disposal													$ -
	Storage Container													$ -
	Monthly Subtotal	$ 0	$ 22	$ 776	$ 431	$ 5	$ 5	$ 79	$ 13	$ 23	$ 1,260	$ 12	$ -	$ 2,626

	MONTHLY TOTAL	$398	$1,024	$1,878	$1,499	$733	$1,441	$2,858	$1,172	$2,000	$6,660	$3,261	$0	**2001/2002 TOTAL = $27,187**

5.0 REFERENCES

Caltrans, BMP Retrofit Pilot Program, Operations, Maintenance, and Monitoring Plan District 7, *Volume II-Appendices BMP Stormwater Monitoring Field Guidance Appendix III* (CTSW-RT-99-052) September 1999.

Caltrans, Storm Water Monitoring and Research Program, *2001-2002 Water Quality Data-Reporting Protocols*. (CTSW-RT-01-057) October 2001.

National Weather Service, *The Climate of Las Angeles California,* May 2002, http://www.nwsla.noaa.gov/climate/climate_intro.html.

National Weather Service, *Public Information Statement for Las Angeles/ Oxnard*, May 1, 2002, http://www.nwsla.noaa.gov/news/may02pns.txt.

Quality Control Summary Report for 2002 Storm Waters
Task Order 05

A total of 981 constituents were measured among 76 samples. Data quality assessment was based upon review of holding times, laboratory method blanks, laboratory control samples, laboratory duplicates, matrix spikes and matrix spike duplicates, surrogate spikes, reporting limits, field blanks, and field duplicates. No constituent results received rejected qualifiers. The following discussion summarizes all qualification based on laboratory performance.

Holding Times

Holding time violations resulted in J qualification of detected results and UJ qualification for non-detects. All holding time violations occurred in methods with holding times of 48 hours or less. These occurrences are most likely related to sample transportation logistics from field to laboratory within the brief holding time.

Summary of Constituent Qualification Caused by Holding Time Violations

Constituent	Total Measured	Total Qualified	Qualifiers	Percent Qualified
NO3-N	33	2	J/UJ	6
Ortho-P	33	2	J/UJ	6
All Constituents	**981**	**3**	**J/UJ**	**0.3**

Method Blanks

No constituents were detected above their respective reporting limits in all method blanks; therefore, no constituents received qualification due to method blank contamination.

Laboratory Duplicates

No constituents analyzed as Laboratory Duplicates had relative percent difference values greater than the Caltrans specified limit; therefore, no constituent results received qualification due to laboratory duplicate outliers.

Laboratory Control Samples

All laboratory control sample recoveries were within Caltrans specified limits. No constituent results received qualification due to laboratory control sample outliers.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

All MS/MSD recovery and RPD values were within Caltrans specified limits. No constituent results received qualification due to MS/MSD outliers.

Surrogates

All surrogate recovery values were within Caltrans specified limits. No constituent results received qualification due to surrogate outliers.

Reporting Limits

If a constituent result value was reported below the reporting limit and had a Numerical Qualifier "=", that value received a J qualifier. No constituent results met this qualification constraint; therefore, no constituent results were qualified for Reporting Limits.

Field Blanks

No constituents were detected above their respective reporting limits in any field blanks; therefore, no constituent results received qualification due to field blank contamination.

Field Duplicates

There are no review criteria for field duplicate analyses comparability. It is expected field replicates may have more variability than laboratory replicates, which only measure laboratory performance. The variance in RPD values observed in these samples is most likely due to heterogeneity of samples.

Summary of Field Duplicate Constituents Exceeding 50 % RPD

Constituent	Number of Analyses
As (total)	1
Cr (dissolved)	1
Cr (total)	1
Cu (dissolved)	1
Fecal Coliform	4
Hardness as CaCO3	1
Ni (dissolved)	1
NO3-N	2
Ortho-P	1
Pb (total)	1
TKN	1
TDS	2
TSS	1
Total	**18**

Total number of constituents analyzed in field duplicates = 203

Percent constituents in field duplicates exceeding 50% RPD = 8.9 percent

Overall Summary

Data quality review indicates that lab results met the overall quality objectives of the program. No constituent results were rejected due to laboratory quality control problems. All constituent results are appropriate for use in the BMP performance evaluation. Any constituent reported as non-detect (Numerical Qualifier "<") received an Overall qualification of "U" in the absence of laboratory quality control qualification.

TECHNOLOGIES

August 31, 2000

Mr. Brian Currier
Water Quality Engineer
CALTRANS
1120 N. Street, Room 4301 (MS 27)
Sacramento, CA 95814

SUBJECT: BMP Operation, Maintenance and Monitoring Plan (Plan) – CDS Units

Dear Brian,

I am writing to comment on and suggest changes to the September 1999 subject Plan. The Plan is thorough and contains all the elements of a comprehensive sampling program; however, I am concerned that the Plan as developed will not result in an objective evaluation of the storm water pollutant removal capabilities of the CDS Technology.

The CDS system is designed to remove gross pollutants including trash and debris and sediments and the attached pollutants including metals, nutrients and oil and grease. The system is also capable of removing free-floating oil and grease when sorbents are applied in the separation chamber. It is not designed to remove dissolved pollutants and bacteria. The efficiency of the unit to remove fine sediments and the pollutants attached to those fine sediments is dependent on the size of particles in the runoff.

The Plan would propose to use automatic samplers to collect influent and effluent samples to determine EMCs. Section 1.4.3 indicates that the efficiency of the CDS unit will be determined through a statistical analysis of this data. In addition the floatables and material collected in the sump basket will be characterized.

Various studies have shown that automatic samplers have limitations in the capture of solids in storm water runoff including particles larger than 100-125 micron. This is extremely important to the successful evaluation of the CDS system because many studies have shown that 80-90% of the particles deposited on highways are larger than this size range. In addition the physical characteristics of the tubing used by automatic samplers and the protective strainers preclude collection of gross pollutants.

CDS has developed a Mass Balance Approach to overcome these limitations that provides for accurately determining the volume and characteristics of the material collected in the sump over a fixed period of time to determine the mass of pollutants collected. The efficiency of the system is then determined by measuring the effluent volume and characteristics discharged or bypassed by the CDS unit to determine the mass of pollutants discharged over the same period of time. Attached is a diagram that helps explain the approach. The efficiency is then calculated by dividing the pollutant mass discharged/bypassed by the sum of that mass and the mass of the pollutant captured in the sump. This approach is very similar to that used by the USGS in the study conducted of the Stormceptor system in Madison, Wisconsin. That study confirmed that

automatic samplers even in that setting had limitations to capture particles larger than 63 micron (upper range of coarse silt).

The Plan can be modified to use the Mass Balance Approach by a few changes to Section 5.9 Characterization of Collected Material. This Section also requires modification to make it consistent with CDS Technologies recommendations for the routine maintenance and cleanout of the sump. The following modifications are recommended:

1. Remove floatables as suggested, but transport to laboratory for characterization rather than hanging on a fence to drip-dry in a mesh bag. That process seems to have little quality control over the management and potential for alteration of the sample particularly in the event of rainfall or loss of chain of custody.
2. The volume of material captured in the sump should accurately measured and representative samples obtained for analysis. This can be achieved by taking the sump contents to the laboratory: however, use of a Phase Separator in the field would provide a better alternative if the sump contents are greater than a few cubic feet.
3. Defined sampling periods need to be established so that the period of monitoring the influent and effluent correspond to the cleaning or removal of captured material from the CDS unit. The original guidance provided by CDS specified the cleaning frequency at four times per year. Based on recent experience we now recommend that the units be cleaned after the first 5 inches of rainfall during the season or when the material is 85% of the sump capacity and at the end of rainy season.
4. The volume and characteristics of the pore water remaining in the sump and separation chamber should be determined to allow completion of the Mass Balance Approach analysis.

The overall efficiency of the CDS system would require reporting of floatables captured and mass balance analysis rather than the comparison of influent and effluent results collected by automatic samplers. The TPH removal efficiencies would be determined from the grab samples of the influent and effluent.

It appears that some cost savings could be realized by eliminating the dissolved metals and fecal coliform analysis since CDS does not claim to remove those analytes. It would also be useful to have the particle size of the material captured by the sump analyzed.

We are available to further discuss the Plan and provide comments on the procedures that can be used for sampling and characterization of the material captured in the sump. Please call me at 1-888-535-7559 if you have any questions about this letter.

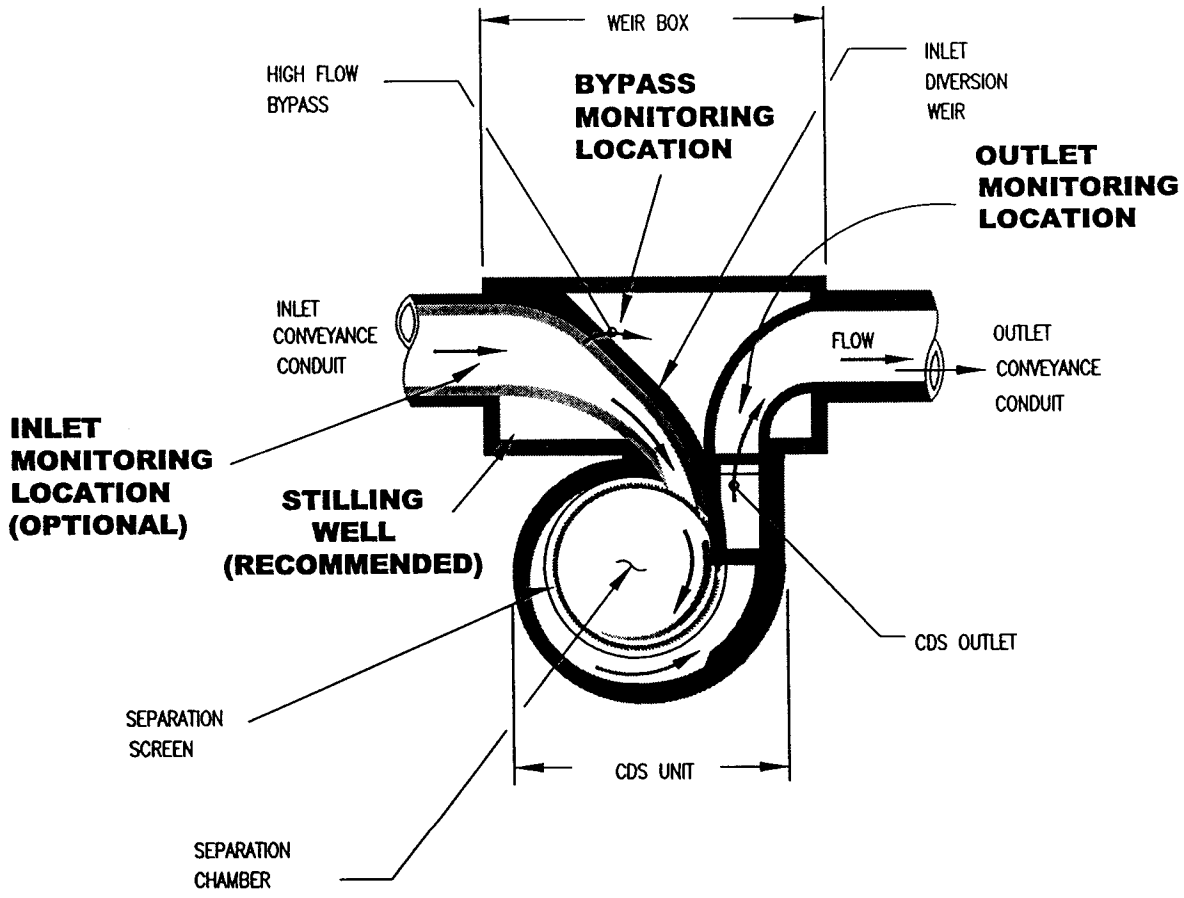
Sincerely,

Robert Howard

Robert Howard
Manager US Operations

Cc/ Edward F. Othmer, Law
Scott Taylor, Robert Bein, William Frost & Associates

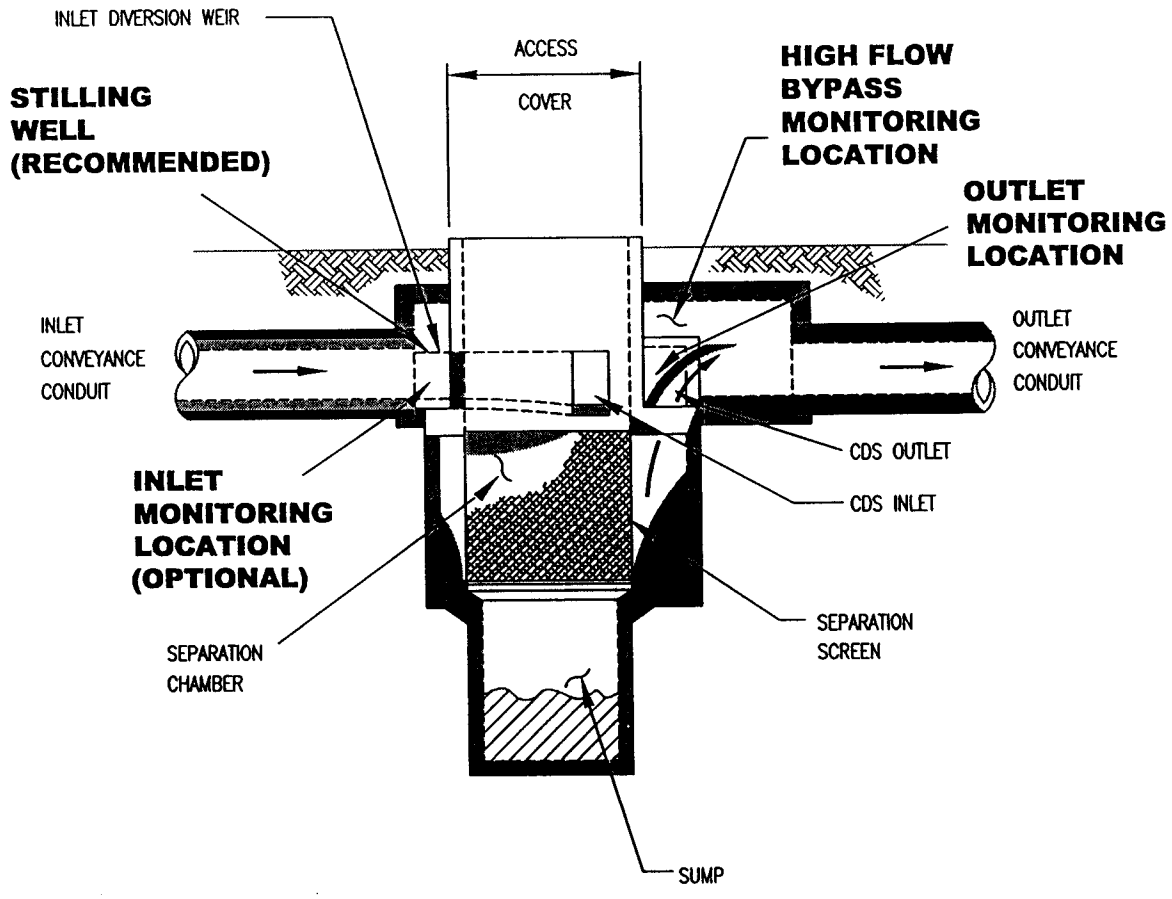
CDS EVALUATION PROTOCOLS - MONITORING LOCATIONS



PLAN VIEW

CDS TECHNOLOGIES

CDS EVALUATION PROTOCOLS - MONITORING LOCATIONS



EFFICIENCY DETERMINATION

$$\text{EFFICIENCY} = \frac{\text{SUMP LOAD + SEPARATION CHAMBER LOAD}}{\text{OUTLET LOADS + SUMP LOAD + SEPARATION CHAMBER LOAD + BYPASS LOADS}}$$

SUMP LOAD = DRY WEIGHT SOLIDS X POLLUTANT CONCENTRATION

SEPARATION CHAMBER = CHAMBER MASS X POLLUTANT CONCENTRATION

OUTLET LOADS = Σ INDIVIDUAL STORM EVENT LOADS (MASS X EMC)

BYPASS LOADS = Σ INDIVIDUAL STORM EVENT BYPASS LOADS (MASS X EMC)

ELEVATION

CDS TECHNOLOGIES